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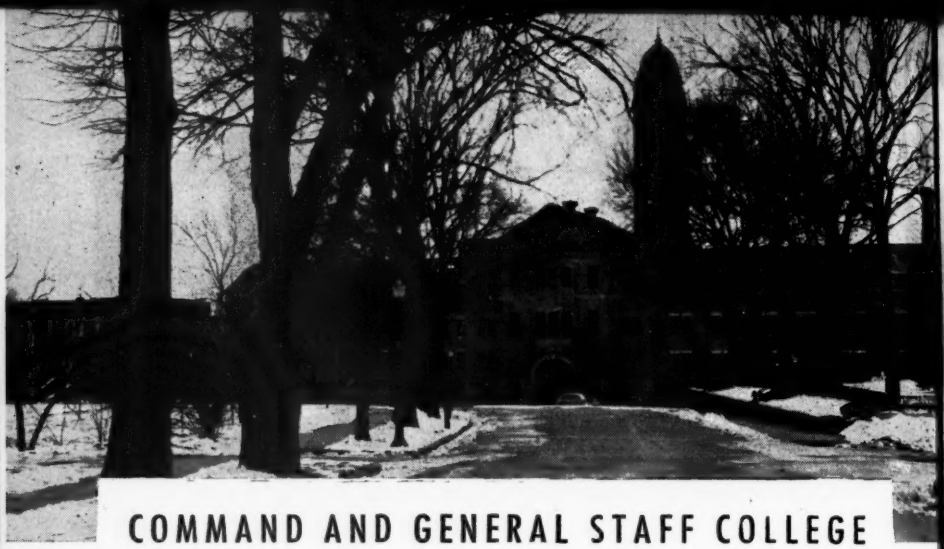

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Technical Competence — *Goal of the Army Air Forces Institute of Technology*

Brigadier General Edgar P. Sorensen
Commandant, Army Air Forces Institute of Technology

THE advent of the Atomic Age has increased the emphasis of the important relation between technical competence of a nation and the virility of its military strength. Furthermore, this strength is derived from the nation's ability to maintain scientific leadership through its research facilities and the people working in these laboratories. We cannot afford to nibble leisurely at the solutions of our research problems and it is equally important that little time be lost in evaluating the military potential of the "raw" results produced at the frontiers of science. The appreciation and direction of research and the conversion of the results of pure science into military application is a grave responsibility for the Armed Services. This responsibility cannot be properly discharged unless members of the military services are educated in a manner commensurate with the scientific problems which are imposed in this complicated technical age.

The rapid strides of air power indicate a vital need for well qualified officers to meet the increasingly difficult engineering and technical problems that face the Army Air Forces. To help to fulfill this need the Army Air Forces Institute of Technology (AAFIT) has been established at Wright Field, Ohio.

The purpose of the Institute is to assure the AAF of a group of officers who can effectively promote and evaluate scientific research and develop its results into practical methods and equipment. This educational program for technical competence, even where it deals with purely academic fundamentals, is keyed to AAF needs. Besides engineering and the administration of engineering it includes the background for matters of procurement, production, supply, and maintenance.

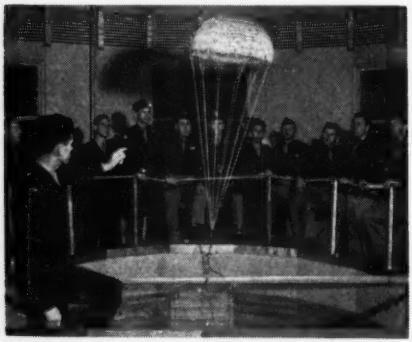
The Institute is an integral part of the Army Air Forces educational system. Although it is part of Air Matériel Command, it receives broad supervision over its curriculum by the Air University, Maxwell Field, Alabama, to ensure that the courses of the Institute are coordinated with the overall AAF educational and training system for officers.

Wright Field, as Headquarters of the Air Matériel Command with its extensive laboratory facilities and technical activity, is an ideal location for this type of education. Both students and faculty have the unique advantage of association with current development projects and the scientists working on them. Because the missions of the Air Matériel Command and the Institute are so parallel, it is probable that many graduates will receive assignment in the command and at Wright Field itself.

The Institute is a military organization in which the commandant is assisted by a civilian faculty. Mr. Ezra Kotcher

is Director and has been associated with the Air Matériel Command for over eighteen years. Before the war he was senior professor of aeronautics at the Air Corps Engineering School. During the war he was on active duty as a commissioned officer working in research and development projects on jet aircraft, guided missiles, and supersonic research.

An important objective of the Institute is to engage and maintain a faculty of



A group of Institute of Technology students observing a model of a ribbon parachute in the vertical wind tunnel at Wright Field. The laboratories of Air Matériel Command provide a wealth of material for study in research and development.

high caliber professional men to assure accomplishment of high level instruction, and to assure their acceptability as professional consultants, within their respective fields, to any agency of the Air Forces. It is contemplated that some assistance may thus be given in connection with current research and development projects in the Matériel Command. Officers and civilian experts of the Matériel Command are likewise called upon frequently to present lectures in their specialized fields. This interchange of assistance is of mutual benefit and is the important factor in maintaining Institute courses virile and keyed to the objectives and requirements of the Air Forces.

Instruction at AAFIT is divided into two broad groups: engineering sciences, and industrial and engineering administration. Most of the individual courses are conducted on the equivalent level of third and fourth year college work and extending into the graduate level. At present, courses are both one and two years in length, depending upon the academic backgrounds of the students. A grading system comparable to that employed by recognized colleges is maintained and high scholastic proficiency insisted upon.

The student body is currently composed of 182 officers, with ranks from second lieutenant to full colonel, and ranging in age from twenty-one to forty-five years. Officers from all parts of the Air Forces, rated and non-rated, pilots, navigators and other specialists, supply and procurement officers, as well as senior officers with command experience compose the student body at AAFIT. A large number of these officers already hold baccalaureate degrees, and all of them have two or more years of college work in civilian institutions. Because of the wide variation in their backgrounds, it was found practical to enter some of these men in a one year program even though the regular course is two years in length. All students are screened into sections or classes according to their previous work.

Entrance prerequisites are that an applicant be an officer either of the Regular Army or of Category I with two or more years of previous college training, including courses in mathematics, physics, chemistry, and mechanical drawing. Applicants are required to have better than average scholastic records.

The school year of the Institute is divided into four quarters of eleven to twelve weeks each. The fourth quarter of the first year of each two year course is devoted largely to orientation courses and work in laboratories of the Matériel Com-

mand. The starting date of the next class is 29 September 1947.

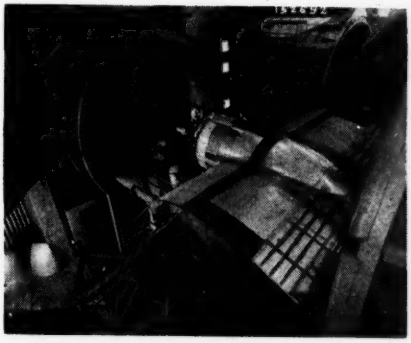
The College of Engineering Sciences within the Institute follows a curriculum established to fit the limitations and capabilities of the 112 students in that college. Newly enrolled students have, in general, been away from academic pursuits for a number of years. To meet this problem, extensive review courses are given in the basic fields of mathematics and physics. On the other hand, after such a review, selected applicants are found capable of pursuing with profit specialized advanced courses in the one year program. There are at present twenty-seven such students in engineering sciences.

The mathematics part of the engineering curriculum embraces an extended sequence in advanced mathematics ranging from calculus through differential equations and vector analysis. In the engineering fields of aerodynamics, thermodynamics and jet propulsion systems, aircraft structures, electronics, nuclear physics, and guided missiles, similar sequences of advanced courses are offered. A small number of electives are included so that a student may pursue even further a particular subject in which he is interested.

Professor Clarance R. Wylie, head of the Department of Mathematics, is Acting Dean of the College of Engineering Sciences. Dr. Wylie came to Wright Field from the Mathematics Department of Ohio State University. During the war he served extensively as a consultant mathematician in the Air Matériel Command's Propeller Laboratory and several other laboratories.

The faculty of the College of Engineering Sciences presently has nineteen members. Six of these hold doctor's degrees, all but three of them a master's degree. Their backgrounds were developed in the leading universities and research laboratories of the nation and they hold membership in an impressive list of scientific associations. From among them comes a long list of published texts and articles.

That part of the Institute designated the College of Industrial and Engineering Administration has seventy students and offers courses more specialized to the management needs of the AAF. Along with basic courses in engineering and mathematics, the curriculum includes the academic fundamentals for a background in production, procurement, supply and industrial mobilization planning.



This engine and nacelle of an Army Air Forces C-74 transport shown mounted in the throat of a Wright Field wind tunnel is an example of the "live" engineering project material that is available to AAFIT students.

Approximately forty per cent of the academic program includes work in basic engineering and science subjects. The balance of the curriculum is concerned with such subjects as law, labor relations, war economics, accounting, corporate finance, and similar activities encountered in the industrial and engineering administration field.

The Dean of this College is Mr. Weldon B. Gibson, who formerly as an AAF officer with the rank of colonel was in charge of requirements for spare parts, supplies, and equipment for the old Air Technical Service Command, later the Air Matériel Command.

The faculty of the College of Industrial and Engineering Administration now has six members. All of these have master's degrees and two of them doctor's. Like the engineering faculty, they hold membership in many professional associations and are credited with extensive writing.

Along with the actual teaching responsibilities of AAFIT, other educational administrative activities are assigned to the Institute. Under the Graduate Section, there is a program set up to assign qualified officers to civilian universities to do graduate specialization in technical fields of study. The Air University has delegated to AAFIT the responsibility of screening applicants for, and monitoring, technical courses while other fields of study are handled by the Air University itself. This military Graduate Section has approximately 200 officers in technical courses at the present time and will send 157 more during 1947. A large group of the leading graduate schools in the country are involved in this program. For example, twenty-five officers are specializing in guided missiles at the University of Michigan, eight are studying servomechanisms, meteorology, and combustion at Massachusetts Institute of Technology, and twelve who are studying aeronautical engineering at California Institute of Technology are specializing in jet propulsion and compressibility. The universities have been very cooperative in assisting the AAF in this program.

Familiarity with such engineering problems as are found about an engine test stand in the Wright Field Power Plant Laboratory are part of the background of courses offered by AAFIT.

Officers who complete this graduate work receive the appropriate master's degree and, upon graduation, the Air Forces policy is to assign them to duties involving their specialty. AAF officers are required to meet the same standards as civilian students in similar courses.

Part of the Graduate Section is the Air Matériel Command Civilian Graduate Center. At the present time only Ohio State University is represented, but the plan allows other schools to participate later. This is a civilian educational program whereby Air Matériel Command scientists, engineers, and others may take graduate work in their elected fields. The actual courses are offered in the classrooms of AAFIT by an Ohio State faculty. Classes are conducted starting one hour before the end of the working day. The other half is on the student's own time. There is a limit of six credit hours per quarter. Resident credit is given toward an advanced degree. At present 237 students are enrolled in twelve fields of study. These fields include mathematics, physics, psychology, physiology, business administration, and aeronautical, electric, mechanical, and chemical engineering.

Another responsibility of AAFIT is handled by its Extension Section. Duties of this Section include the preparation of correspondence type courses of a tech-

nical nature which will be used through the Air University to augment the training of National Guard and Organized Reserve Corps Officers. This part of the program is still in its early stages. The Extension Section also screens the technical talent of the Air Matériel Command for the wealth of speaking ability that is available and arranges for these speakers to appear at such places as the Industrial College of the Armed Forces and the Air University. The Extension Section is concerned with the technical speaker only and is not a so-called popular speaker's bureau.

Still in the planning stage is a Meteorological Department which may become a part of the College of Engineering Sciences. Meteorology courses are being planned on both a graduate and undergraduate level to furnish well qualified AAF meteorologists primarily for advanced work such as is contemplated for the recently established meteorological research laboratory.

The Institute of Technology is not a new idea. It is the modern version of one of the oldest and best known schools in the AAF. After World War I, the Air School of Application was instituted at McCook Field in Dayton, Ohio. It went through subsequent changes in name and policy, finally becoming the rather well known Air Corps Engineering School. It was moved to Wright Field when that field was ready for occupancy early in 1927. Classes were small and, even including the somewhat war-swollen classes of 1944-45, only 394 officers were graduated from the program from 1919 until 1946.

Among the graduates are many of the well known names in aviation and the AAF today. Generals George Kenney, James Doolittle, and many others are on that list.

In 1946 the program was enlarged and increased in scope to become the AAF Institute of Technology, with its first class beginning on 3 September. As indicated above, the current program and curricula of the Institute were designed to meet the more pressing current needs of the Air Forces in raising the technical educational level of its officers.

The recent war interrupted the college education of great numbers now in the service. The best interests of the service dictate a major effort to extend the education of a maximum number to the graduate level and of a selected group in special technical fields of postgraduate study. The condition caused by the war and the integration of new officers who have not completed four years of college education is regarded as temporary, but several years will be required to correct it. A considerable part of the corrective action will be accomplished by sending officers to civilian educational institutions, some for undergraduate study and others for postgraduate work.

The Institute of Technology is now helping to carry this load of undergraduate education and to screen and prepare some officers for graduate study. It is confidently expected that, in keeping with changes in the situation, the courses of study offered by the Institute will be gradually raised to the graduate level with undergraduate courses provided primarily for refresher purposes. The flexibility of its organization and capabilities, its close association with live projects in research and development and with individuals conducting them, its ability to make some use of Matériel Command laboratories and to visit Air Force Proving Grounds together with its access to classified material all serve to place the Institute of Technology in a distinctly unique position in its ability to cope with the problems of educational preparation of officers to meet the ever-changing and expanding technical requirements of the Air Forces.

Logistics Looks Ahead

Colonel G. K. Withers, Corps of *Engineers*
Instructor, Command and General Staff College

The views expressed in this article are those of the author and not necessarily the views of the War Department.

MUCH has been said and written recently about new weapons and new developments in warfare. The implications of these new weapons on air and ground operations have been discussed. It is appropriate that very serious consideration be given to the effect of these new developments in warfare on logistics in general and on the communications zone in particular.

Let us try to look ahead, therefore, to a time twenty years or so from now when we can reasonably expect the use of well developed guided missiles with ranges approximating 1,000 miles; atomic bombs; new aircraft in great numbers capable of carrying tremendous tonnage or travelling at supersonic speed; and poison gas of great deadliness. We will carefully stay within the bounds of reason, but all of these weapons exist at present in an imperfect state, so it is only probable and realistic to assume their development and use in twenty years. The present article does not pretend to predict the future, but merely to point out trends, make suggestions, and stimulate thought.

It has already been pointed out that the communications zone offers much better targets for these expensive new weapons than does the combat zone, and unless we radically change our present logistical procedures, such establishments as ports of debarkation, airports, large headquarters, railroad yards, industrial centers, storage depots and towns are sure to receive the full force of the enemy's guided missiles, bombings (both atomic and ordinary), and other long range weapons. This greatly increased concentration of attack on the communications zone cannot be doubted, for it was used as predicted during the last war when London and Antwerp were the targets of guided missiles, and when German and Japanese industrial centers were bombed by our forces.

Assuming, then, that the communications zone will receive its full share of attack by these new weapons, we must try to visualize the effect this will have on logistics in general, and the communications zone in particular. We must consider both the offense and the defense, as both types of action will be affected by these new developments. Logistical procedures will be greatly affected and radically changed in defending against the enemy's attacks, while the supply and support of these new weapons for our own offensive use will create many new problems for the communications zone. We can, of course, only make conjectures as to the changes that will take place as a result of these new developments in warfare. As they affect logistics and the communications zone of the future, the

change, we believe, will be radical and far reaching.

The first questions that naturally arise are: Will there be a communications zone? Will there be a combat zone; or a theater of operations; or a zone of the interior? The answer is that there may or may not be a communications zone as we know it, depending on the exact pattern any atomic age war may take. It will depend unon whether one or both of the contesting powers have and use atomic bombs, and upon how successful the initial attack will be in destroying the opponent's capacity to fight or his will to fight. As has been previously pointed out, there may or may not be a communications zone, or even a combat zone. For the purpose of this discussion, we can assume that there is a communications zone, but even if a communications zone did not exist as we know it today, the *functions* of furnishing logistic support to the combat operations would certainly remain, and would have to be taken over by the zone of the interior or some other agency under, perhaps, a new name. Regardless of what you call it, some agency must furnish the supplies, evacuation and hospitalization, transportation, services, and management required to support any combat operation. The necessary work must be done by someone, somewhere, and logistic support must be furnished, whether there is an old fashioned communications zone or not.

Let us, therefore, try to foresee and visualize the effect of new developments in warfare on logistics in the communications zone. In so doing, we should keep in mind four conclusions already brought out concerning the trend of future warfare. First, the power of the offense has been increased, and warfare will be open and characterized by rapid movement. Second, future warfare will require greater dispersion of all elements. The corollary to this conclusion is that forces must be concentrated rapidly for combat and support of combat. Third, military personnel must be better trained and better disciplined in the future. Fourth, airborne operations in future war will be on a scale and of a magnitude unknown at this time. Many think that the next war will be largely airborne, and may be fought in any part of the world, with particular emphasis on bases in, and transit across, the polar regions. In examining the effect of all this on logistics in the communications zone, it will help to consider separately how supply, evacuation and hospitalization, transportation, services and management are affected, as these five subjects cover the entire field of logistics.

First, then, let us see how supply will be affected. Overall tonnage of supplies requested will greatly increase. In World War II the tonnage of supplies sent to Europe was six times the tonnage shipped in World War I. This tendency to increase the quantity of equipment and supplies required to wage war has existed throughout the ages, and will no doubt continue. That it will increase in the ratio of 6 to 1 as it did in the last war is not improbable, especially if we consider the weight per man supported. The total tonnage may not be so high due to the probable shorter duration of the next war. As has been the case in all previous wars, the number and complexity of the items to be supplied will also be greatly increased, which will not make the task easier. In the last war over 800,000 items (not counting Air Force) were supplied. Most of the new items will be regulated items, pertaining to new weapons, and will be complicated, highly technical, very secret, and terribly expensive. In other words, they will be very hard to procure. Although they will be manufactured in the zone of the interior, they will be scarce and difficult for the communications

zone to procure from the zone of the interior. Local procurement of such new weapons will be out of the question, and this illustrates another trend shown in all recent wars, and which will no doubt continue in the future: combat forces cannot live off the land as they used to, and in each succeeding war become increasingly dependent on their line of communications for supplies. This means, of course, more transportation—more elaborate logistical support. We can just hit the high spots in this vast field, so let's move on from procurement of supplies to storage.

Storage of supplies will be even more radically affected by future trends in warfare. Everything must be dispersed for protection against these new weapons, and this really presents a problem—as yet unsolved. Where an Ordnance depot in the last war, containing, say 150,000 tons of ammunition, occupied an average space of ten square miles, the same depot in a future war will require about one hundred times the space or 1,000 square miles. This is because the area required varies as the square of the distance between piles of material. Of course, in actual practice, such dispersion would be absurd, for, at this rate, there would not have been enough space available in the British Isles to disperse properly the supplies required to mount the invasion of Europe, and all of France would have been required to disperse the supplies we had on hand there when we crossed the Rhine. However, this example illustrates the magnitude of the problem. Underground storage will be used where suitable deep mines or natural caves already exist, but this will be rare and will not help much, due to the difficulty of moving supplies in and out, lighting, ventilation, etc. For instance, gasoline, in drums or cans, cannot be stored in a closed space due to danger of fumes and explosion. It will be difficult enough to find space in which to disperse supplies, but the real difficulties, of course, are the tremendous increases in transportation involved, the extra time required, the additional manpower required, the access roads to construct, and the difficulties of communications, guarding, controlling and managing. Unless we do disperse, however, the situation will be, perhaps, similar to that at Anzio, where so many supplies were stored in such a limited space that it was practically impossible for the Germans to fire a shell without hitting a pile of ammunition.

The distribution and issue of supplies will likewise be made increasingly difficult by their dispersion and the dispersion of the using troops themselves. Much more transportation, time, and manpower will be required, and more documentation and management will be essential to keep all transactions straight. The difficulties of storing and distributing supplies in the communications zone, as outlined above, will, in my opinion, preclude the buildup and storage of large stocks or reserves in the communications zone of the future, and such action would probably be inadvisable anyway, because of the rapidity of movement of future war. It may well be that practically all reserves will be kept in the zone of the interior, and delivered by air directly, or as closely as possible, to the using unit. Such action would obviate some of the difficulties of storage and distribution, but would require an enormous air fleet and great skill to operate successfully.

With this brief discourse on supply, let us hurry on to the special problems in connection with evacuation and hospitalization that will be encountered in the future. Three new problems are to be faced by the Medical Corps in addition to all of the old ones. As I see them, they are: One, special facilities and new methods of treatment must be developed to overcome or protect against the effects of radioactivity on military personnel due to atomic bombing or the use of radioactive dust. This may well

become a major cause of future casualties, and very little is known at present on this subject except that radioactivity is deadly, dangerous, and unpredictable. Two, there will be the threat of poison gas to protect against, and this will require great vigilance, a high degree of technical skill, and doubtless many new supplies. Three, the greatly increased care and treatment that may be required by the civil population of the communications zone due to the effects of radioactivity, and poison gas. I am thinking only of the minimum care and treatment required to prevent interference with military operations, but it is conceivable that this may reach staggering proportions. The sanitation problem alone, created by the sudden death of 100,000 people, such as occurred at Hiroshima, is very unpleasant, but one that must be dealt with if the area is to remain habitable. It is believed, and hoped, that new developments in medical science will help offset the terrible effects of these new weapons. Much progress in reducing deaths by disease has been made in recent years, and fewer men died of disease in World War II than in World War I. The trend is definitely downward, and it probably will continue downward.

Transportation is apt to be more radically changed by new developments in warfare than any other logistical service, because one of the new developments—larger, faster, and longer range aircraft—is a means of transportation. The two main transportation agencies used at present for moving tonnage in quantity are ships and railroads. However, both ships and railroads are easy and vulnerable targets for the new weapons. Railroad yards, shop facilities, and bridges will not be easy to destroy, even deep in communications zone territory. Large ports of debarkation will be prime targets for atomic bombs, and they cannot be replaced in time to do any good. The large convoys of ships used in the last war to supply the communications zone will also be prime targets, and presumably, as at present, single vessels will be attacked by submarines and by long range aircraft. It appears, then, that airplanes will become the most realible means of inter-theater transportation in future wars. It is not at all unrealistic to make this assumption. Just recently the newspapers showed a picture of a new army cargo-carrying plane, the XC-99. According to the newspaper it will carry either 400 troops or 50 tons of cargo. Much larger planes are, of course, probable in the near future, and promising new power plants are under development which may greatly increase the speed and range of aircraft. It is confidently expected that in the near future cargo planes will be capable of carrying all but the heaviest pieces of equipment required in the communications zone. Rocket-assisted take-offs are already obviating the necessity for tremendously long run-ways, and it is hoped and expected that the use of rockets to decrease landing speed will likewise shorten the landing strips required.

Of course, the large airports that will be required to receive the great number of cargo planes handling communications zone supplies will also be excellent targets for guided missiles and bombing. Again, to put it mildly, we will be greatly inconvenienced by the necessity to disperse. However, this will fit right in with our previously discussed scheme to send supplies from the zone of the interior direct to the using units, insofar as possible, in order to avoid the necessity of large depots. As said before, such a scheme will require considerable working out, but it does seem feasible.

All this seems very nice, but there is one—at least one—big fly in the ointment. How will we bring in our gasoline and oil? During the last war petroleum supplies

were brought to the theaters in tankers and constituted almost fifty per cent of the total tonnage of supplies brought in. This is big business, running into many millions of tons. In a future war, the trend indicates that gasoline and oil requirements will greatly increase, because it will be a war of movement and more transportation will be required for dispersion and concentration. The use of cargo planes as our principal freight carrying agency will probably more than double our already fantastic requirements. Even if the planes of tomorrow are capable, as they may well be, of carrying enough fuel for the round trip from the zone of interior and return, it will still be most difficult to find a substitute for the ocean going tanker to bring in the millions of tons of gasoline required for combat operations. In view of diminishing reserves of oil it will be no small problem to procure the petroleum. Its loss by enemy action would be very serious. The answer may be in the use of submarine tankers, or possibly even in the development of a new fuel, or in the use of atomic power. This is apt to be, in any event, a major logistical problem.

Assuming we get the gasoline to the communications zone in one way or another, pipelines will be used to distribute it to the users to a much greater extent than they were used in the last war. They will be of improved design, lighter in weight, and will be laid, and repaired when broken, with great speed. Storage tanks will have to be dispersed, concealed, and put under ground to a greater extent than ever before.

In regard to transportation within the communications zone, our chief reliance will probably be on motor vehicles capable of full cross country travel, and designed to operate successfully in polar regions at temperatures of 70° F below zero, in desert regions, and in tropical jungles. They will also operate on very soft thawing ground and will probably be amphibious. Roads will be used when possible, of course, but they will all be subjected to attack with long range weapons, and cannot be depended upon. Cargo planes will undoubtedly be used for transportation within the communications zone to a much larger extent than ever before, and it is conceivable that they might largely supplant ground transportation for the longer hauls. This will probably depend on which develops the faster during the next twenty years. It is doubtful if railway, or inland waterway transportation, will ever again be of major importance within the communications zone as they will be too vulnerable, and the war will have moved on before repairs can be made.

The services required in support of combat operations by the new developments in warfare will be much greater than ever before. This has been a very definite and constant trend in every war to date since the beginning of time, and it will no doubt continue. With each war, the proportion of actual fighting men has decreased, and the proportion of men in support has increased. This is merely another way of saying that the importance of logistics in modern warfare is increasing, and this tendency is being definitely accelerated by each new advance in scientific development. It appears quite definite, then, that more service troops will be required, but many of them will perform their functions in the zone of the interior, in line with the trend already discussed, that of the zone of the interior taking over former communications zone functions of storage and distribution. Many new services will, however, be required in the communications zone in support of new developments in warfare, so it is doubtful if there will be any decrease in service troops therein. In fact,

it appears there will be an actual increase. Dispersion calls for more service troops in many ways. Manpower has always been the ultimate bottleneck in spite of the machine age, and its procurement will probably continue to be critical. No matter how many labor saving machines are invented, there are always new tasks that machines cannot yet perform. Let us see what some of the new services required by, or in support of, our new developments in warfare will be.

Construction is not a new service, but many kinds of construction, and in quantities greater than ever before will be required. Such increase in construction is also a definite trend shown in every war to date. It will probably be necessary to build and repair more roads and bridges to provide alternate routes and increase the mobility required to disperse and concentrate rapidly. Since the entire communications zone will be subject to long range missiles and bombing, much more repair work to all structures and installations will be necessary. Dispersion of hospitals and other installations away from town and target areas will mean more construction. Many more airfields will be required, and these must be designed and constructed to support an airplane weighing possibly 250 tons. Underground shelters will be very popular and many will be required for use as headquarters, hospitals, storage space for critical supplies, and also, no doubt, for use as assembly plants for new weapons and launching sites for guided missiles. There will be many such underground shelters, and they will be large and deep. They will have to be constructed more rapidly than we are able to do at present if they are to be of value in the increased tempo of future war. More speed will be necessary in all construction work, but it is hoped and expected that new construction equipment and methods will be developed. Artificial harbors were built in the last war, and further developments along this line can be expected, with such wild schemes as floating airfields which can be rapidly assembled, being distant possibilities.

Another service that will be more necessary than ever in future war is maintenance. This is almost axiomatic, as it is plain that the constant trend towards greater mechanization, and the new and more complicated weapons being developed will require more elaborate maintenance processes to keep them in good repair. This will mean more shops and more highly skilled technicians. It would almost appear that the service troops of the future will have to be partly scientists of electronic psysicists to be able to do their job. There will be Radar, and Shoran, and Loran, and infra-red equipment for large-scale night operation. New and better radio communication will be a necessity due to the greater dispersion and faster movement of the forces. Television and facsimile transmissions of orders and requisitions will be commonplace. Even a simple service such as water supply will probably be complicated and made more difficult, and greater care must be exercised. It is believed that practically all technical service equipment of the future, including heavy engineer equipment, will be made air transportable by the use of larger cargo planes, rather than by reducing its size. Furthermore, it will be designed to operate either in the arctic or in the tropics. We can summarize the service required by future trends in warfare, then, by saying that there will be more construction, more maintenance, and a higher proportion of service troops. These service troops should be highly skilled technicans and they will need a lot of training. Such training cannot be initiated after the war has started.

The fifth and final heading under which

the effect of new weapons on logistics should be considered, is management. It has been already pointed out on the tactical side that better leadership and discipline will be needed, and the job of the small group leader will be more difficult. It is also very obvious that the management problems of the communications zone, including command, organization, and control of the four elements just discussed, will be more complicated and difficult because the job is bigger and tougher in every respect. Better management will be required. This calls for a better organization; a tighter, more closely knit organization, with better discipline and control. In the past there has been no standard table of organization for any large or supervisory logistical unit such as we have in the division, corps or army on the tactical side. Logistical organizations, such as communications zones and base sections were generally loosely knit. They rose and fell, grew up, and died away during the last war, as required. They were not a permanent, integral unit like an infantry division, and by the time they got used to working together and learned their job they were generally closed out and broken up with a resultant waste of training and experience. It may be necessary to copy, in effect, the organization of large tactical commands in order to achieve the better management required. A step in this direction has already been taken, and the War Department has recently considered tentative tables of organization and equipment for a logistical division. Such an organization is clearly necessary to provide the exacting management and close control required to furnish logistic support in a future war. It is a flexible organization, with a definite nucleus, which is built up to fit any situation, and it could be used equally well in the combat zone, communications zone, or in the zone of the interior. It may well be that this idea will be carried a few steps further, and we might find a logistical division assigned to each army to take the place of the army service troops. Certainly, this would provide better control and unity of command than the present, loosely organized assemblage of service troops, and such assignment would tend to make combat troops logistically self-supporting. Also, we may find logistical divisions replacing the base, advance, and intermediate sections of the communications zone, and instead of a communications zone, these logistical divisions might logically form a logistical army. There would be many advantages to such an organization in addition to those already pointed out. Logistical divisions could be shifted from one army to another as needed, the same as infantry divisions. Great flexibility would result, and they could be trained and made available in emergency for duty anywhere from the zone of interior to the combat zone. Better discipline, greatly improved morale, and much more efficient logistical support would be the result.

Now that we have considered separately, if very briefly, how supply, evacuation and hospitalization, transportation, services and management are affected by future trends in warfare, let us try to put it all together and draw some conclusions as to what it means and the overall effect on logistics.

We have tried to develop the picture of the future along the usual, orthodox lines. Practically every prediction has been made in accordance with a definite trend in warfare that has been going on for many years and these trends will probably continue for at least another twenty. These trends indicate that more supplies, more transportation, more service, more management, more of everything will be required, and probably even more labor needed. The new weapons and equipment will be technical and complicated; they will be more difficult to produce

and very much more costly. This latter point is one that will soon have to be considered. The cost of killing an enemy soldier has gone up so high that it may become impossible for any nation to bear the tremendous expense of wiping out an enemy.

While more and more of everything will be required, needed items will become increasingly difficult to get. This will be the result of the effectiveness of our new weapons. They will be able to cripple our production of war material in the zone of the interior. By enforcing dispersion of manufacturing facilities, they will increase the difficulties of manufacture. We will not be able to build up large reserves in depots, or to use large ports or airports and the use of our two best means of transportation, ships and railroads will be denied us; yet more transportation will be required due to dispersion, and rapid movement. Better management will be necessary and it, too, will be more difficult to obtain. From the logistics viewpoint, this is an intolerable situation, a solution for which must be found.

It has always been true that defense lags behind offense. A new weapon has to be developed before the defense against it can be perfected. Similarly, logistical support must necessarily lag behind the development of new weapons. This has been true throughout the ages, but with this difference: We have this time made more than an ordinary improvement in our weapons. We have made the tremendous power of atomic energy available in a bomb —a weapon—but we have not yet made atomic energy available as a work horse, to be used by the logisticians in support of the new weapons. This is a tremendous gap that has developed between the offense and the defense. It is even more of a gap between combat operations and their proper logistical support.

It would appear, then, that some new scientific advance or new tool must come to the aid of logistics before the new weapons of modern warfare can be supported logistically over any protracted period of time. It is not unlikely that some new development such as new fuel, a new means of using electrical energy, or atomic power will be made available and come to the aid of logistics within the next twenty years. When and how this will occur, however, is anybody's guess. We have examples of such developments in the recent past. Consider the vast improvement in power and economy of the steam turbine over the old steam engine. Consider the increased power and simplicity of the turbo-jet engine or rockets over the reciprocating gas engine with its many parts and mechanical troubles. In each case more power is available with less trouble and greater simplicity. The point is, however, that until such a new advance is made, logistic support and production cannot keep up for very long with the destruction caused by the new weapons. At present the situation is badly out of balance, and the important and unanswerable question is—when will the balance be restored? In the meantime, rigid and strict supply discipline will be of the utmost importance, and might well be the deciding factor in winning or losing a war. It is a point that has been neglected badly in the past and it is, therefore, all the more important in future considerations as there is farther to go.

The conclusion drawn from all this is that aside from a quick, onesided war, involving a well prepared versus a weak power, the newly developed weapons forseeable within the next twenty years cannot be supported or sustained logistically at present, except for very short periods. When can they be supported is problematical, but means will probably be developed within the next twenty years.

The action required in the interim

period is to be fully prepared and to hit back hard and immediately if attacked, with a well protected force that cannot be destroyed. The enemy will then be at least as badly off as you are, and until new scientific advances occur which will enable logistic support to keep pace with the new weapons, the war will be forced to revert to the old fashioned type—unless one side has made a terrible mistake and has been caught unprepared, in which case it will be all over.

There were many other emergency movements of freight which had direct strategical implications. One of the earliest and most important was the shipment of 300 medium tanks and 100 tank destroyers, with spare parts and ammunition, to the hard-pressed British forces in Egypt following the fall of Tobruk. Advice that these tanks were to be moved reached the Chief of Transportation on 27 June 1942. Special trains were run from various tank depots and training centers, and six freighters were assigned to handle the movement. By working day and night, the New York Port of Embarkation had the ships loaded and ready to sail on 13 July. One of the vessels was sunk by a submarine in the Atlantic, but the others proceeded. Replacements for the lost equipment were assembled immediately, and the *Seatrain Texas* was assigned to lift them. She left New York unescorted on 29 July and, because of her greater speed, was able to overtake the original convoy before it arrived at Suez. The following May, in addressing the Congress of the United States, the British Prime Minister spoke frankly of the vital part which that equipment played in the British victory at El Alamein and in the long pursuit of the German forces across North Africa to Tunisia.

Report of the Chief of Transportation

New Name

General Orders Number 16, Headquarters, Command and General Staff College and Fort Leavenworth, Kansas, 8 May 1947, establishes a new designation for this school. The order reads as follows:

"Pursuant to the provisions of Circular 107, War Department, 29 April 1947, announcement is made of the redesignation of the Command and Staff College as the Command and General Staff College effective 25 April 1947."

The New Armored Division

Lieutenant Colonel D. M. Oden, *Cavalry*

Organization

THE new armored division, as approved by the War Department, will give our Army the most powerful unit of its type in the world. With over twenty-five per cent increase in medium tank and infantry strength compared to that of the previous armored division, this new organization approaches the armored striking power of the former heavy type division, and contains a better ratio between tanks and infantry than was available in the light armored division. Tank and infantry battalions are organized symmetrically, thus permitting balanced tank and infantry teams throughout all division tactical formations. The additional infantry also increases the division's defensive and "staying" ability.

A 155-mm howitzer battalion, self-propelled, and an antiaircraft artillery automatic weapons battalion, self-propelled, are added to the division artillery, assuring the habitually necessary medium artillery and antiaircraft support which was found so desirable and essential to armored operations during World War II.

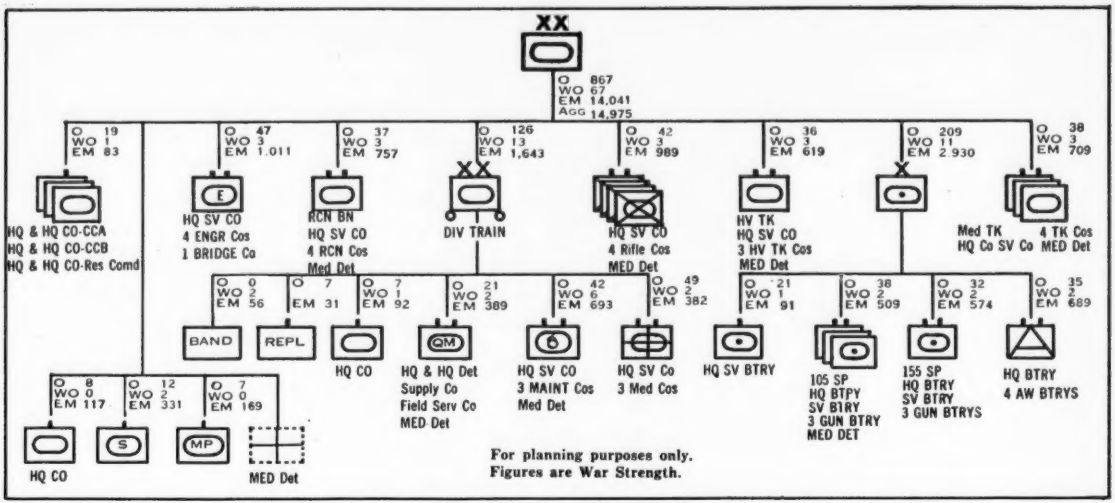
The reserve command remains a unit in the division and is augmented in strength, equipment, and communications to equal that of combat commands A and B. The new armored divisions has three general officers in its T/O, as has the infantry division, since both combat commands A and B are now commanded by brigadier generals.

The separate battalion organization which proved so successful is continued in the new division, endowing it with the greatest degree of flexibility and, at the same time, providing for the development of stronger and more capable battalion commanders.

Other desirable additions to the division are a heavy tank battalion, to be utilized primarily in the antitank role and for blasting out exceptionally stiff resistance; a supply battalion for adequate minimum logistical support; an additional lettered company and a bridge company in the engineer battalion, plus nineteen fulltracked engineer special vehicles which add greater mobility to the division; a military police company in lieu of the former platoon; and now, as an organic unit, a replacement company to receive, process, and indoctrinate incoming replacements during the war. Also adding to the division's mobility is the replacement of the half-track personnel carrier with a full-tracked vehicle and the elimination of the armored car. The light tank, M-24, is substituted for the latter.

Whereas the old light division numbered 10,865 officers and men, this new armored division shows an aggregate strength of 14,975.

As in all armored divisions, the tanks remain the striking force. The new organization boasts three medium tank battalions, each consisting of a headquarters and service company, and four medium



For planning purposes only.
Figures are War Strength.

MAJOR ITEMS OF EQUIPMENT

A Airplane, Liaison 21
E Compressor, Air Truck Mounted 6
E Crane, Truck Mounted, ¾ yd. 4
E Semi-Trailer, Low Bed, 20-Ton 7
E Shop Equipment, Motorized, General Purpose 1
E Tractor, Diesel Engine Driven, 35-60 DBHP D-4 1
E Tractor, Diesel Engine Driven, 75-90 DBHP D-7 6
E Trailer, Low-Flat Bed 8-Ton 1
E Trailer, Utility, 2 ½-Ton, Type I 19
E Truck, 2 ½-Ton Bolster W/Semi-Trailer 32
E Truck, Cargo, Treadway, 6-Ton 16
E Vehicle Engineer Armored, Tank-Dozer Type 12
E Water Supply Equipment, Set No. 1 Engineer 6
E Welding Equipment, Trailer Mounted 4
M Truck, 2 ½-Ton, Dental Laboratory 7
O Car, 5-Passenger, Medium Sedan 1
O Carriage, Motor, 105-mm Howitzer 1
O Carriage, Motor, 155-mm Howitzer 6
O Carriage, Motor, Multiple Gun M16 1
O Carriage, Motor, Twin 40-mm Gun M19 19
O Carrier, 81-mm Mortar, Half Track 32
O Gun, Machine, Cal .30 Heavy 16
O Gun, Machine, Cal .30 Light 80
O Gun, Machine, Cal .50 518
O Mortar, 60-mm 568
O Mortar, 81-mm 48
O Motorcycle, Solo 20
O Semi-Trailer, Transporter 6
O Tank, Light W/Armament 12
O Tank, Medium, M4A3E8 58
O Tank, Medium, M26 216
O Tank, Medium, M45 63
O Truck, ¼-Ton 24
O Truck, ¾-Ton, Ambulance 734
O Truck, ¾-Ton, Weapons Carrier 48
O Truck, 1 ½-Ton, Cargo 66
O Truck, 2 ½-Ton, Artillery Repair 116
O Truck, 2 ½-Ton, Cargo 4
O Truck, 2 ½-Ton, Dump 804
O Truck, 2 ½-Ton, Electrical Repair 61
O Truck, 2 ½-Ton Instrument Repair 4
O Truck, 2 ½-Ton, Machine Shop (Load A) 4
O Truck, 2 ½-Ton, Machine Shop (Load B) 1
O Truck, 2 ½-Ton, Signal Corps Repair 3
O Truck, 2 ½-Ton, Small Arms Repair 4
O Truck, 4-Ton, Wrecker 4
O Truck, Tractor Transporter 19
O Truck, Wrecking, Heavy 32
O Vehicle, Tank Recovery 28
O Vehicle, Utility, Armored, M44 402
Q Trailer, Laundry Washer and Extractor 2
Q Trailer, Laundry, Dryer 2
Q Trailer, 1-Ton, Refrigerator 2
Q Trailer, Bath Unit, fld, M1945 4
W Truck, Decontaminating, Power-Driven 3

tank companies. The time-honored five tank platoon remains in all tank companies, both medium and heavy. The normal three platoon organization is continued in the medium tank company. In the heavy tank battalion, there is a headquarters and service company, but only three tank companies. Each tank company in this battalion, however, is organized into four platoons of five tanks each. Until a satisfactory heavy tank is developed, the M-26 medium tank will be utilized in the heavy battalion. The initial standard tank for the medium battalions is the battle-tried M4A3E8.

The four infantry battalions, like the medium tank battalions, are square. That is, each consists of four rifle companies, plus the headquarters-service company. The infantry is better distributed for tank support than it has been in the past. Rather than the old heavy company of 257 officers and men, the new companies have only 204. The twelve-man squad has been replaced by one of ten men, making it identical to the nine-man squad found in the new infantry division, plus a driver for the personnel carrier. The old towed antitank platoon of the armored infantry company is eliminated, and there are now sixteen rifle companies in the division as compared to the former nine. At last there is sufficient organic infantry to the division to perform practically all roles assigned, without additional immediate infantry support from other sources.

The reconnaissance platoons of the infantry and tank battalions are identical to those in the reconnaissance companies of the reconnaissance battalion, and the battalion headquarters of the infantry battalion is organized similar to that of the tank battalion and the reconnaissance battalion, thus facilitating the ease and capability of that headquarters to operate task forces. Consequently, by organizing two balanced task forces, each of two tank and two infantry companies, functioning directly under each of the tank and infantry battalion headquarters, a combat command commander has two units of equal striking power with communications, and control available. The four battalions of infantry provide for support of any three tank battalions, while at the same time, resting, refitting, and reinforcing one of them; or, all may be grouped as

M-26 "Pershing" Medium Tank. (Signal Corps photo.)

required, for operations demanding the primary characteristics of infantry.

Based on performances during World War II, little improvement could be expected in the organization of division artillery. The six-gun, self-propelled batteries of the armored artillery battalions were the answer to a tanker's prayer for rapid, flexible, violent, and accurate artillery support. Medium artillery was found to be necessary in practically all instances, and this one major deficiency is now corrected. Instead of the old towed twelve-gun battalion, which in the past was a normal attachment to armored divisions, the new armored division contains a battalion of eighteen highly mobile, self-propelled 155-mm howitzers organized into a headquarters battery, a service battery, and three six-gun firing batteries.

The habitually attached antiaircraft

artillery battalion of the past war is now a bona-fide member of the division, and further, it is included in the division artillery family where it finds a permanent home with someone to look after its welfare. This valuable addition contains a headquarters and service battery, and four firing batteries. Each firing battery consists of eight M-16 quadruple .50 caliber mounts and eight M-19 dual 40-mm Bofors.

M-44 Armored Utility Vehicle.
(Ordnance photo.)

The Bofors guns are mounted on the light tank chassis.

The three 105-mm howitzer battalions are almost identical to the light armored artillery battalions of the past, each including a headquarters battery, a service battery, and three six-gun firing batteries. The division artillery thus remains extremely mobile, capable of providing the minimum essential artillery support for all types of armored formations, and also finds itself charged with air protection, not only for its own units, but also for other divisional units.

The cavalry reconnaissance squadron, in name, has been eliminated, and a reconnaissance battalion substituted therefor. This change in terminology is due to the proposed consolidation of the cavalry and armored forces into the "armored cavalry" arm, and to an effort to simplify nomenclature of the divisional units by referring to all of the combat units of the division as battalions.

The organization of the reconnaissance battalion consists of a headquarters-service company, and four reconnaissance companies. The light tank company, the assault gun company, and the armored car have been eliminated, and the light tank, M-24, substituted for the latter throughout the battalion.

The engineer battalion is the largest single unit in the division. It aggregates a strength of 1061 officers and men, and consists of a headquarters-service company, four lettered companies, and a bridge company. In addition to the three Diesel tractors normally transported on a 20-ton trailer, which formerly comprised the full tracked special equipment of the engineer battalion, this unit now has sixteen additional full tracked special engineer operations. Most of these are on tank chassis.

Division trains headquarters and headquarters company, the ordnance battalion, and the medical battalion undergo few, if any, changes in organization. Two valuable units have been added, however, as has been pointed out, i.e., (1) the QM supply battalion, consisting of a headquarters company, a supply company, and a field service company; and (2) a replacement company of seven officers and thirty-one enlisted men. Division special troops include the division headquarters company, the signal company, and the military police company.

Tactical Formations

The organization of the new armored division necessitates no changes in the fundamentals of employment or formations as outlined in FM 17-100. On the contrary, the doctrines promulgated therein are more apropos today, for they were generally followed during the past war and recommendations, which pertained to organizational change, of the various wartime armored divisions are embodied

in the new division to carry out better the concepts of that manual.

Three senior tactical headquarters are provided to assure maximum flexibility and control in combat. Combat commands A and B are to do the fighting, and consequently are headed by brigadier generals, whereas a colonel commands the reserve command. Further, the division is, in some respects, now a square organization. This fact is attested to by the four line company, tank and infantry battalions.

During the last war, the armored infantry battalion had three rifle companies, and the tank battalion had three medium companies and a light tank company. Many commanders were prone to form two task forces, utilizing the infantry battalion headquarters, its commander and staff to operate one, consisting of the infantry battalion less one rifle company, reinforced by one medium tank company; and the tank battalion headquarters, its commander and staff to operate the other, consisting of the tank battalion less one medium tank company, reinforced by one infantry company.

Experience proved, however, that the most violent, powerful, and hard hitting basic force of combined arms was a team composed of a medium tank company and an armored infantry company. The normal task force organization, as delineated, was merely a makeshift one, utilizing what many people considered the best breakdown possible with the forces available. But the records show that usually the infantry battalion task force found itself short of tanks, and the tank battalion task force found itself insufficient in infantry. Consequently, in armored organizations at least, it is apparent that three is not the magic number and the powers that be, by placing four rifle companies in the infantry battalion and four medium companies in the tank battalion, have provided future task force commanders with a possible combination of two medium tank and two infantry companies in each task force, thus giving each force commander two of those unexcelled teams in his command. Another interesting feature in the organizational change of the infantry battalion provides that headquarters with communication facilities equal to those of the tank battalion, facilitating control of the task forces operated by the infantry units of the division.

Almost invariably, in combat, every armored division had attached at least one 155-mm howitzer battalion. This amount of medium artillery was essential, in practically all instances, to prevent prohibitive losses, and to increase the violence of the action. But most of the attached medium artillery battalions were twelve-gun towed units, and were with the division one day and detached the next. The inclusion of a 155-mm howitzer battalion, self-propelled, in the organization of division artillery, makes available to the division, habitually, that essential minimum medium artillery for employment directly under division control or in support of the combat command meeting the most stubborn resistance.

The light tank company and assault gun troops of the old cavalry reconnaissance squadron do not appear in the reconnaissance battalion of the new division. There are light tanks in each reconnaissance company in the new organization, and it is felt that the reconnaissance tanks will ordinarily prove sufficient for necessary tank action. If not, with the added tank strength in the division, medium tanks can be attached. By substituting the light tank for the armored car, the mobility of the reconnaissance battalion becomes equivalent to that of the other combat units of the division. Probably the most noteworthy observation regarding the organization of the division reconnaissance

agency is that, in the future, it will ordinarily fight for information, rather than seek it by stealth.

In considering normal attachments and the manner in which it was fought, this division differs little from the light armored division of World War II in strength and command organization. Major changes effected give the division better logistical support, a great increase in infantry and tank strength and firepower, a desirable increase in artillery, a further trend away from the light tank as a major combat vehicle, and a marked additional mobility. In the future, further improvements and refinements in both organization and equipment will be accomplished. For the present, however, the organization and equipment of the new armored division incorporate practically all of the essential changes deemed necessary by combat men during the last war, and constitutes a highly mobile, flexible, balanced armored fighting unit.

The study of military affairs should not be regarded as an emergency matter, although outbreak of war gives it added importance and urgency. What is required is a long-term program of research, and ultimately of teaching, which will enable the United States in times of peace as well as war to build up and utilize a body of expert knowledge essential to the formulation of public policy and to the understanding of military problems and potentials. A reserve of trained scholars who had devoted any considerable portion of their lives to problems of strategy would be of immense service to the nation. . . .

Dr. Edward Mead Earle

The Evolution *of the* Replacement System

Lieutenant Colonel Carl L. Elver, *Infantry*
Instructor, Command and General Staff College

This is the first of two articles on the subject of the Replacement System in our army by Colonel Elver. The second article will appear in a subsequent issue of the MILITARY REVIEW.—The Editor.

ONE of the methods retained by a commander whereby he may influence the outcome of an action after his forces have been committed to combat is by the employment of his reserve. The replacement stream moving into a theater of operations constitutes a strategic reserve of major importance to the theater commander. The size of this reserve may be illustrated by reference to the European Theater of Operations. About 88,000 replacements were available in the United Kingdom on D-day to support the invasion. By VE-day the replacement command in the theater comprised 20,000 permanently assigned personnel, a training cadre of 6,000 and a replacement stockage of 111,000. During the period of hostilities 2,100,000, or nearly half the personnel in the theater, had been processed through the replacement command.

Replacements have been called the life blood of the fighting army. By the infusion of new replacements, seasoned units are enabled to continue operations indefinitely, while the recent arrivals are more quickly taught the important lessons of combat through the close association with the experienced veterans.

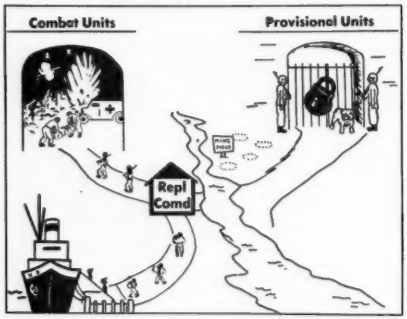
These are lessons we have learned through bitter experience. Prior to World War I, our army had no replacement system. Indeed, our military policy precluded such a system.

Prior to 1917, our war-time American Armies were divided into separate forces, the Regular Army, a volunteer army, and the militia of the several states, all maintained by competitive recruiting methods, each offering ballyhoo, bounties and short terms of enlistment as inducements. In default of a centralized federal system of mobilization and manpower procurement, all forces, except the regulars who were always a trifling part of the whole, were raised by the states and offered to the federal government as diversely organized units. Since this system depended heavily upon the efforts of community leaders to induce their fellow citizens to join, and since these leaders expected thereby to become the captains and colonels of the new units, the natural tendency was to raise replacements, not by filling old regiments but by raising new ones and letting the old ones dwindle into inefficiency.

The evils of such a policy became apparent during the war with Mexico, when the success of General Scott's campaign was seriously threatened by the discharge, within a hostile country and in the middle of a campaign, of volunteers whose terms of enlistment were about to expire, and who comprised a total of seven of the

eleven volunteer regiments under his command. The period of inactivity that ensued, because of the lack of replacements, delayed the termination of the campaign several months and resulted in unnecessary loss of lives.

During the Civil War the North persisted in the use of state forces raised by volunteering, accepting new units while allowing old regiments to diminish by disease, deaths, desertions, straggling



Replacements are not available for manning provisional units.

and by evacuation of hospital patients to points outside the control of the military authorities. New organizations, bringing with them new patronage, kept coming in. These incoming units required a relatively long time to train, because of the absence of any leavening of veterans. By the end of the war, some regiments had fallen in strength to as low as 100 men, while others had many times that number.

On the other hand, the Confederate Government profited by the lessons of history. In 1862, the Confederate Congress enacted a draft law. Virginia had already established compulsory service, so that 30,000 men from that state were infiltrated into the Southern Army facing McClellan. Thus the South developed a system of replacements whereby recruits would quickly gain the stamina of the older regiments.

Although at the outbreak of World War I there was still no effective replacement system in our army, all forces called to the colors were federalized and combined into the Army of the United States, and conscription was substituted for competitive recruiting. The original plan for the organization of the American Expeditionary Force provided that in each corps of six divisions there would be four combat divisions and two divisions designed to form parts of the replacement system, one of which was to be known as the replacement and school division, and the other as the base and training division, later called the depot division. The depot division was to receive all replacements from the United States, provide for their training, and keep the replacement division supplied with personnel. The latter division would, in turn, forward replacements to the combat divisions as losses occurred.

The urgency of utilizing every available man in the fighting lines prevented the full implementation of the plan. Two depot divisions were finally established and furnished the replacement support for the entire American Army. None of the replacement divisions was designated, and in their stead, a provisional replacement battalion was organized for each corps. The shortage of available replacements which developed resulted in the skeletonizing of several divisions—including the depot divisions—to provide replacements, and prevented full development of the replacement system.

The initial planning of the War Department in 1917 did not make adequate provision for a replacement system in the United States. Although a replacement system was eventually established, as urgently recommended by General Pershing, it was done too late to be of material benefit even to the last divisions which were sent to France in the fall of 1918.

During the postwar period, some study

of replacement problems was made by the War Department, but the size and importance which the replacement reserve was destined to reach was not fully realized prior to, and even during, the early phases of World War II. Replacements were considered a special class of supply; the method of handling them was to be prescribed by the theater commander.

The first combat experience in which replacements were brought into play in World War II occurred in the North African Theater. The lack of an effective replacement system resulted in a chaotic replacement situation. Because of insufficient prior planning, inadequate facilities, poor coordination, inexperienced personnel assigned to replacement duties, and a lack of understanding of the replacement mission and requirements, serious deficiencies developed rapidly.

As a result of the experience gained in these operations, the War Department in May 1944, directed the establishment of a uniform replacement system in each theater of operations, stated the basic principles of replacement organization, and prescribed the matters which should be included in the replacement plan.

Replacement commands were organized in all theaters in compliance with the War Department directive. A comprehensive program for the procurement, training and shipment of replacements to the theaters was developed in the zone of interior. By the end of the war, an efficient army-wide replacement system had been developed which had been able to maintain combat units at effective strength, or to provide for their rapid rehabilitation for further operations.

The primary mission of the replacement system in time of war is to maintain all units and installations at effective strengths.

The Director of Personnel and Administration, War Department General Staff, is responsible for the operational control of the replacement system. His responsibilities include:

a. Supervision of procurement of personnel, by recruiting, by induction through the Selective Service System, by calling individual reservists to active duty, and by the appointment of officers from all sources.

b. Supervision of induction and reception processing procedures.

c. Allocation of personnel in such a manner as to balance requirements and resources.

The Commanding General, Army Ground Forces, and the chiefs of technical and administrative services are responsible for training personnel for zone of interior and theater of operations assignments, as fillers and as replacements.

Army commanders (zone of interior) are responsible to:

a. The War Department for the operation of agencies required for the procurement, induction and reception of personnel.

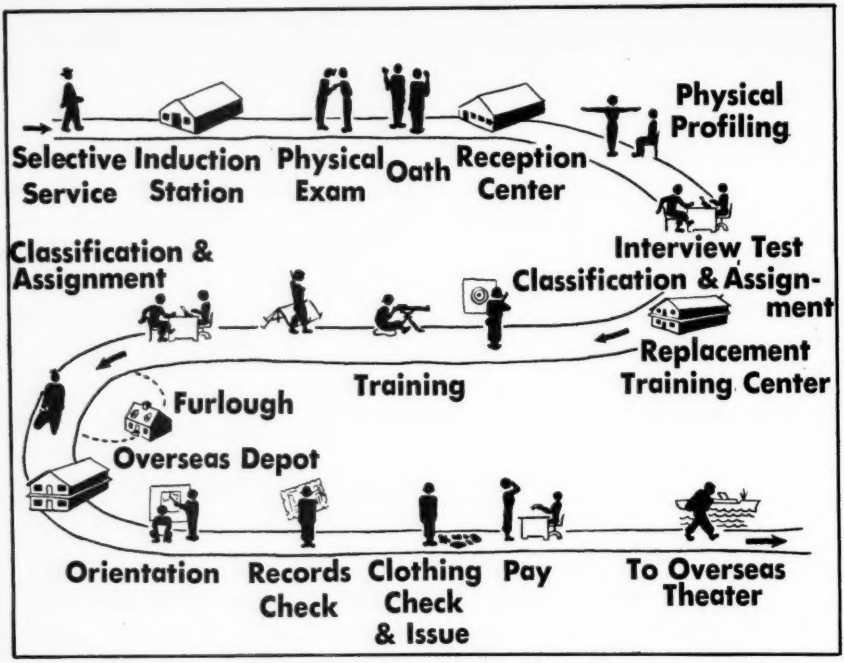
b. The Commanding General, Army Ground Forces for the operation of replacement training centers and schools pertaining to the Army Ground Forces.

Chiefs of Administrative and Technical Services are responsible for the operation of facilities for the training of specialists pertaining to their services.

The replacement system takes charge of inductees from the time that, in response to their draft calls, they report to the *induction stations*, where they are received, given their physical examinations and the oath is administered.

The inductees are sent from the induction stations to *reception centers*, where they are interviewed, their classification determined in order to utilize their civilian experience to the greatest extent possible, and their clothing and equipment is issued.

From the reception centers they are sent to appropriate *replacement training*



Replacements flow in the Zone of Interior.

centers. Here they receive basic and other training necessary for the performance of their future duties. Some of them will be selected for further training as specialists; others may be sent to officers' candidate schools; most of them, however, must be trained to become combat soldiers, since by far the heaviest casualties will be sustained by the combat arms.

Upon completion of the training period, some of them may be sent as fillers to combat units which are being activated in the zone of interior, some may be assigned to duty in zone of interior installations, and the rest of them will become replacements. Those replacements required by theaters of operations are sent to a zone of interior *replacement depot*. These are installations established in the vicinity of the ports of embarkation or other communications routes into the theaters with the primary mission of preparing replacements for movement to the theaters. Personnel are checked to insure that only those meeting established War

Personnel audits are essential to efficient utilization of manpower.

Department standards are sent to the theaters of operations, and that all administrative requirements in connection therewith are completed.

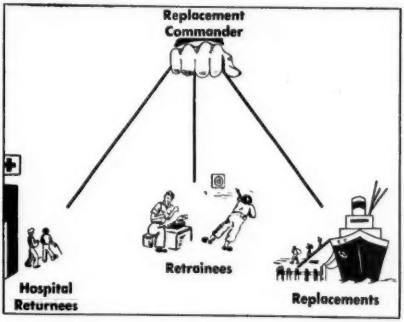
As required, and as transportation is available, replacements are formed into casual detachments and sent to the theaters of operations.

Within the theater of operations, the establishment and operation of an effective theater replacement system is the responsibility of the theater commander. The replacement system must provide for the continued efficiency of theater units by providing for the maximum utilization of available theater manpower and the maintenance of theater units at effective strengths. The theater commander must establish an effective control over all unassigned personnel in the theater, and insure that replacements are utilized only for the purpose of maintaining authorized units at effective strength. He must also maintain a continuous audit of personnel within the theater to locate potential assignments within the theater for men not capable of combat duty, and to locate men capable of combat duty who are currently assigned to positions which can be filled by limited assignment personnel.

The theater replacement command is the principal operating agency of the theater replacement system. It is a major command directly responsible to the theater commander, having a coordinate status with the major tactical commands and with the communications zone.

The commanding general of the theater replacement command is responsible to the theater commander for the administration and operation of the replacement system. He normally commands all ground force replacement installations in the communications zone and all unassigned personnel in the theater, except personnel attached to units and installations not under his command.

Replacement installations in the communications zone consist of replacement depots and separate battalions, which are normally assigned specialized missions in order to prevent unnecessary overlapping of functions. *Port or receiving battalions or depots* are established at the major ports to receive replacements as they arrive, and to transfer them to other replacement installations within the theater as required. *Stockage depots* are located along the line of communications for the purpose of holding combat trained replacements until they are required in the combat zone. *Communications zone support depots* and *specialists depots or battalions* are located as centrally as possible in the communications zone for the purpose of holding highly trained specialists and other replacements for the communications zone. *Training depots* provide for retraining limited assignment personnel for duties in service organizations, or for conducting the retraining of general assignment personnel withdrawn from service organizations for use as combat replacements. If the theater need for officers becomes sufficiently large, training depots may be established for the conduct of officer candidate schools. *Hospital returnee depots* perform the function of receiving and processing patients discharged from hospitals in the theater. If these hospital returnees are qualified for their former



Theater Replacement Command controls all unassigned personnel in the theater.

duties they are returned to their former units. Those who have become limited assignment must be assigned to service duties, either directly or after retraining.

Replacement support of the field armies during the past war was usually furnished by a replacement depot operating in the army area, but remaining under the command of the commanding general of the theater replacement command. Post war studies have generally recommended that in the future, the army replacement depot be attached to army. While a final decision has not yet been made, the present trend of thought in the War Department is toward the adoption of the plan. Under either method, the general policies governing assignment classification and utilization of replacements are prescribed by the theater commander.

An army replacement depot normally places one of its replacement battalions forward in direct support of each corps in the army. Although during the past war there was no provision for a replacement unit in the division, the present organization of the infantry and armored division provides for a division replacement company to provide for the reception, processing and accommodation of replacements received in the division.

At long last the experiences of wartime operations have guided us into the development of a replacement system which provides for the procurement, training and delivery of replacements from the induction station to the fighting divisions when and where they are needed. If this country is ever involved in another war the efficiency of that system will depend upon the continued study of our replacement plan, continued changes in its operation to meet new developments, training of all officers of the army in replacement principles and problems and the assignment to replacement duties at all levels from War Department to replacement company of outstanding officers especially trained in their field.

War on so vast a scale demanded long-range planning of the highest order. The opening of new theaters and the launching of repeated assaults against enemy-held territory involved visualization of the requirements for men, matériel and shipping far in advance of the event. When a military operation was finally decided upon, it was with confidence that whatever means might be necessary to its initial and ultimate success would be available.

Report of the Chief of Transportation

The Occupation of Korea
— *Initial Phases*

Lieutenant Colonel Duncan Sinclair, *Field Artillery*
Instructor, Command and General Staff College

This is the first of two articles by Colonel Sinclair on this subject. The second article will be published in a subsequent issue of the MILITARY REVIEW.—The Editor.

WHILE everyone knows that there are United States troops on occupation duty in Korea, few people are aware of the problems facing those troops. Fewer people realize the significance of the occupation, or that in Korea, United States forces are striving to establish a democratic form of government in the face of terrific odds. The purpose of this article is to tell the story of the occupation of Korea and provide a background against which readers can more readily evaluate future developments. The article is in two parts, the first of which describes Korea and the planning and preparation for the occupation. The second part will cover the actual occupation, its difficulties and accomplishments, and current developments in the Korean situation.

The Country

Korea is a peninsula extending south from the southeast border of Manchuria and lying between the 34th and 43d parallels of north latitude. China lies across the Yellow Sea to the west. Eastward across the Sea of Japan are the main islands of Japan. North to south its greatest dimension is about 525 miles while its east-west width varies from 125 to 200 miles. In size, Korea with 85,206 square miles is just a little larger than Utah (84,916). Official 1941 estimates placed the population at 25,000,000 of which 2.9 per cent were Japanese and 0.3 per cent other nationalities (mostly Chinese). On 17 September 1946, the published results of the first census taken since liberation placed the population of South Korea (United States zone, south of 38° north latitude) at 19,369,270, and the population of the capital city of Seoul at 1,141,766.

Korean winters are relatively dry and cold, while the summers are moist and hot. Of the average annual precipitation, 85 per cent falls between April and September, with July the wettest month. Winter temperatures vary between —40° F in the north and a few degrees below freezing in the south. Summer temperatures are consistently high but not extreme, averaging between 83° and 88° F.

The peninsula is extremely rugged, dominated by a large mountainous mass in the north and northeast, a long nearly continuous chain extending southward along the east coast, and several tributary ranges and spurs running southwest from the east coast range. Consequently, the eastern coast is steep and rugged with small isolated pocket lowlands, while the western coast is low but very irregular, broken up by rivers and finger ranges from the east. In 1941, Korea had 4,213 miles of railroad with another 665 miles (estimated) constructed since that year.

Of the total, 3,522 miles are government owned and operated. The principal line, from Pusan through Seoul, P'yongyang (headquarters of the Russian occupation forces) to Antung on the northwest border, is a double-track, four foot, eight and one-half inch gauge road which runs on

to Mukden. In 1938, official vehicle highway mileages were:

1st class roads (24 ft or wider) 1880 miles

2d class roads (18 ft to 24 ft) 5460 miles

3d class roads (12 ft to 18 ft) 7240 miles

Little paving materials are used except in and near the larger cities, and all roads suffered severely through lack of maintenance during the war. Also as a result of the war, individual motor vehicle ownership and operation has been greatly reduced. Most of the vehicles and trucks which were not conscripted by the Japanese have been converted to use charcoal, carbon and acetylene. Today, the most common forms of highway transportation are the bicycle, ox-cart and rickshaw.

History

According to legend, Korean history began in 2333 B. C. when Tangun, the incarnation of a divine wind, established a dynasty and taught the people the rudiments of civilization. Tradition also has it that in 1122 B. C. the great Chinese sage, Kija, with some 2,000 followers established the kingdom of Chosen (Morning Calm). Then followed the kingdoms of Silla and Koryu, but it was during the Yi dynasty, which started in 1392, that Korean culture reached its zenith. Metal movable printing type was invented, anticipating Gutenberg by fifty years. The present 26-letter alphabet was established, astronomical instruments of a high order were made, and a whole new literature was published.

In 1592, Hideyoshi, the Japanese military dictator who had determined to conquer the world, invaded Korea with an army equipped with flintlocks. Without similar weapons, the Koreans could offer little opposition, but at this time the Korean Admiral Yisunsin invented the world's first ironclad vessel, a fleet of which attacked and destroyed Hideyoshi's flotillas to bring the invasion to a halt. Then, with Chinese assistance, the Koreans drove the Japanese out, but the country never recovered from the effects of the invasion, and Korean hatred for the Japanese dates from these times.

Following this Japanese invasion, Korea adopted a policy of rigid seculsion, although continuing to recognize China as suzerain, and became known as the Hermit Nation. Of recognized strategic value to Russia and Japan, Korea was to become a buffer in the political movements of the three countries. However, Japan eliminated Chinese influence in 1895, and with the treaty of Portsmouth which ended the Russo-Japanese War in 1905, Russia recognized Japan's "paramount political, military, and economic interests" in Korea.

Japan established a protectorate over

the country which bloomed in 1910 into complete annexation, ending the reign of the Yi dynasty. All this was subtly accomplished with utter disregard for previous Japanese pledges to respect Korean independence and for the protestations of the American consuls, the first of whom had taken his post in 1882. With the annexation, the Japanization of the country began with the change in name of the capital city from Seoul (Korean) to Keijo (Japanese). The same was done for all Korean cities, and even today all Korean cities and towns have two names, although Korean names have been restored since American occupation. Japanese schools were opened, books and newspapers were printed in Japanese, and a government-general, largely staffed by Japanese, was established.

Japanese business men and officials infiltrated every business and commercial enterprise so thoroughly that although the Japanese composed only 2.98 per cent of the population in 1941, they controlled very nearly 100 per cent of the country's enterprises. Naturally, the Koreans, proud of their heritage and history, resented the encroachment, but the Japanese ruthlessly destroyed every effort toward revolution and independence. The Koreans tried in vain to present their case before the peace conference in Paris, the Washington Arms Limitation Conference, and the League of Nations in Geneva. Secretly a provisional government was created in Seoul in 1919 whose elected president was Dr. Syngman Rhee (an American-educated Korean who was in Washington at the time and has headed the Korean Commission in this country since 1922). Reports indicate that the provisional government was reorganized on a committee basis with a chairman, as well as a president. Dr. Rhee was later succeeded as president by Kim Koo. Thus, since 1910, Korea became an unwilling satellite of Japan, who never succeeded in dominating the independence-loving Koreans. The following quotations from Japanese Army publications dealing with the proper methods of treating Korean soldiers are somewhat indicative of a wishful-thinking attitude towards a race which was supposedly honored by the Japanese rule:

"The present-day Korean is, ideologically speaking, generally neutral and is no cause for concern. A few individuals, however, possess a latent race-consciousness and liberal ideas.... You must make them understand that to become leaders in greater East Asia, they must be assimilated into the Japanese race, which is unique in the world in that it originated from one source, and that Great East Asia exists only when the Empire prospers."

"As part of their character training, their bad eating habits must be checked gradually. They are very much concerned about food, particularly about the amount and share they receive. They often show their unrefined habits during such times as field maneuvers."

"The use of good Korean soldiers both in and out of the army is a very effective method not only to promote the aim of our conscription system but also to Japanize the Korean people. They should be used as much as possible in the army, since they prove to be very useful in the training of other Korean troops. However, Koreans should not be grouped together in the army, and racial friction should not be allowed to arise between Koreans and Japanese."

United States Interests

Readers will wonder how the United States ever got involved in Korean politics. As indicated above, the first American consul took his post in 1882, and our country has been represented there except for three years, 1942 to 1945, when the Japanese evacuated American consular officials to Japan for shipment aboard the Gripsholm. A considerable number of schools and churches have been established

and operated by American missionaries, and most of our college campuses have seen Korean students (Dr. Rhee, mentioned above, is a Ph. D. from Princeton University). Also, American financial interests have found their way to Korea. In general, the United States has adopted a friendly attitude throughout the years, has voiced objections to any sign of aggression by an outside nation, and has entered into business and economic relations. Then, at Cairo, in November 1943, President Roosevelt, Prime Minister Churchill and Generalissimo Chiang Kai-shek announced:

"The aforesaid three great powers, mindful of the enslavement of the people of Korea, are determined that in due course Korea shall become free and independent."

On 26 July 1945, the same three powers reaffirmed this determination in the Potsdam declaration:

"The terms of the Cairo declaration shall be carried out and Japanese sovereignty shall be limited to the islands of Honshu, Hokkaido, Kyushu, Shikoku and such smaller islands as we determine."

Operations "Baker"

On 8 August 1945, Russia declared war on Japan and endorsed the Potsdam declaration, thus becoming a guarantor of Korean independence. On 14 August, Japan surrendered and the task of occupying Korea and Japan was given to General MacArthur, who had been designated Supreme Commander for the Allied Powers. For this task, General MacArthur's staff had developed the "Baker" series of operations which sent the Sixth and Eighth Armies from the Philippines to Japan and the Tenth Army from Okinawa to Korea. So far as Korea was concerned, there were to be three phases:

1. *BAKER 40*—to occupy the Seoul area, to establish control of Japanese Government and Army-Navy command, and to prepare for further overland and short-range amphibious operations.

2. *BAKER 41*—to occupy the Pusan area and to establish ground forces and air landing facilities.

3. *BAKER 42*—to occupy the Kunsan-Chonju area and establish ground forces and air landing facilities.

The Tenth Army, on Okinawa, was rehabilitating after the struggle for the island which had ended on 22 June 1945, and had been looking ahead to participation in the invasion of Japan when the sudden turn of events assigned it an occupation role in Korea. But scarcely had the staff embarked on its planning when another change—this time from theater headquarters—substituted the XXIV Corps for Tenth Army. The latter remained charged with mounting all XXIV Corps units and with rounding up all Japanese in the Ryukyus area, while the XXIV Corps was given the job occupying Korea. The troop list called for three reinforced infantry divisions—the 7th, the 27th and the 40th—plus some 21,000 corps

troops, and 24,000 service troops to establish and operate Army Service Command (Ascom) 24. Revision of the troop list reduced these figures slightly and substituted the 6th Infantry Division for the 27th. The mission which was assigned to the XXIV Corps is interesting not only in its differences from a combat mission but also in its completeness:

1. Occupy Korea south of 38° north latitute and adjacent off-shore islands.

Note:—To effectuate the Japanese surrender, the principal Allied Powers (US, USSR, GB, China) agreed to the establishment of certain "surrender areas" within each of which an Allied Commander was designated to accept the surrender of Japanese forces. In Directive No 1, issued 2 September 1945, by SCAP to the Japanese Government, the limits of these areas were spelled out in an order which the Japanese Government was directed to issue to oppropriate agencies. By the terms of this order, all Japanese forces in Korea north of 38 degrees north latitute were ordered to surrender to the Commander in Chief of Soviet Forces in the Far East, while all Japanese forces south of that latitute were ordered to surrender to the Commander in Chief, U.S. Army Forces, Pacific. There has been speculation as to when and why the 38th parallel was selected as the line dividing Russian and United States Zones in Korea. Some have believed that it was established at the Yalta Conference in February 1945. However, neither the official conference communiques nor the conference terms, as recently released by the Department of State, lend support to this belief. Too, there has been speculation that there were ulterior reasons for the choice of the 38th parallel. That the line of demarcation was intended to be temporary and only to fix responsibility between the USSR and the US in carrying out the Japanese surrender was recently reiterated by Assistant Secretary of State, John H. Hilldring, as indicated by the following excerpt from his speech before the Economic Club of Detroit, Michigan, 10 March 1947.

"Totally different from these political agreements (Cairo and Potsdam Declarations and Moscow Decision, December 1945) is another agreement which has given rise to the unfortunate division of Korea into two zones. In the fall of 1945, shortly after the sudden surrender of Japan, the military forces of the US and USSR entered Korea in order to accept the surrender of the Japanese forces which were located there. There had been no fighting in Korea, so there were no allied troops within that country. Because it was necessary that the surrender of the Japanese be taken by the troops more readily available, it was decided that Soviet troops would accept the Japanese surrender north of the 38th parallel of latitute and the American troops would accept the surrender south of it. In no sense was this agreement more than a military expedient between two friendly powers. The line of demarcation was intended to be temporary and only to fix responsibility between the US and the USSR for carrying out the Japanese surrender. Nevertheless, now, nearly eighteen months later, this artificial and 'temporary' line still stands like a stone wall against the unification of Korea.")

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2. Receive the surrender of Japanese forces of all arms.

3. Establish control over the armed forces and civil population and impose thereon prescribed terms of surrender requring immediate military action.

4. Occupy and defend sites in Korea for radar and aircraft warning installations as arranged with Commanding General, Far East Air Forces.

5. Establish facilities in Korea for air force units as arranged with Commanding General, Far East Air Forces.

6. Assist the United States Pacific Fleet as necessary in the establishment of naval facilities for naval search and control of coastwise communications.

7. Be prepared to assist in the establishment of a separate post-war government and army of occupation in Korea and to transfer responsibilities to these agencies when established and as subsequently directed.

8. Establish control of the following:

a. Japanese military forces, headquarters, and installations.

b. Transportation centers, river crossings, and other critical points.

c. Communications centers and facilities.

d. Government buildings, records, and key officials.

e. Police headquarters, post offices, banks, stock exchanges, utilities, and other critical civil installations and facilities.

9. Plan and conduct all operations in such a manner that forces are constantly prepared for combat in event of a resumption of hostilities, treachery, or sabotage.

10. Enforce the surrender of Japanese forces of all arms and be prepared to apprehend war criminals as may be directed.

11. Disarm Japanese armed forces and their auxiliaries and establish control of military resources as rapidly as the situation permits.

12. Destroy hostile elements which oppose by military action the imposition of surrender terms upon the Japanese.

13. Suppress activities of individuals and organizations which may be inimical to the operations of the occupation forces.

14. Insure that law and order are maintained among the civilian population.

15. Facilitate peaceful commerce, particularly that which contributes to the subsistence, clothing, and shelter of the population.

16. Secure and safeguard intelligence information of value to the United States.

17. Recover, relieve, and repatriate allied prisoners of war and civilian internees without delay.

18. Seize and impound all military records relating to the Japanese military and naval establishments.

19. Be prepared to impose terms of surrender beyond immediate military requirements as subsequently directed.

Problems

Like the Tenth Army, XXIV Corps had fought through the entire Okinawa battle, and its units were resting and rehabilitating when the occupational mission came along. This happened about 17 or 18 August, and the target date was 8 September. Five days had to be allowed for the overwater movement, which left approximately sixteen days for *all* planning, preparations, and loading to be completed! This would have been a difficult task under favorable circumstances, but additional obstacles were present, all due in large measure to the sudden collapse and surrender of the Japanese. First, there was a shortage of intelligence on Korea. Joint Army-Navy intelligence studies of Korea were available in very limited quantities, as were maps. This supply improved almost daily as a result of emergency air shipments and super-human efforts on the part of engineer reproduction units. Considerable quantities of aerial photographs were called for and received, while the corps G-2 uncorked a very lively source of information when he discovered several Koreans among the Japanese prisoners which were held on Okinawa.

Another big problem was the release of service units and the conversion of combat units. Service units which were to accompany the corps were all engaged in current supply operations on Okinawa and to release them from operating without replacements was a serious strain on the supply structure of the island. On the assumption that there would be little or no active resistance, it was decided to convert several field artillery, antiaircraft artillery and armored units into military police units. The decision meant turning in excess weapons and equipment, drawing different equipment, to say nothing of retraining the personnel in military police duties.

Billeting was another bugaboo. It was hoped that the soldiers might be spared the necessity of sleeping on the ground and in the open, yet there was little information available to indicate what

types and amounts of billets could be provided. Furthermore, it was necessary to remember that the occupation troops would be entering a friendly country, and any requisitioning of billets which might result in hardship for the Koreans would certainly create ill-feeling. It is true that the Japanese government had been directed to establish in Japan a central liaison agency, one of whose functions was to provide billets and other space requirements, and the Japanese government had also been directed to see that the central liaison agency established a branch in Korea to assist the occupation troops in that country. But realizing that the influence of the Japanese would wane sharply and progressively with the anticipated arrival of American troops, it was extremely doubtful whether any such agency could succeed too well in its acquisition of buildings and billets.

There was a great need for advice from the State Department on the approved (or desired) methods of dealing with Korean leaders and of arranging the surrender ceremony. At Theater Headquarters in Manila, there were experts who could and did supply much sorely needed advice with respect to surrender arrangements. But there were no Korean experts available until inquiry revealed two American mining engineers in Manila who had been in Korea for many years. They volunteered their services, and from Washington the State Department sent Mr. H. Merrill Benninghoff, former consular official in Seoul and in Tokyo. These three gentlemen were of immense help in orienting commanders and staffs and providing detailed information of the country.

By far the greatest difficulty facing the corps in Korea was the establishment and operation of a government. In Japan there was no such problem, for the existing government was to remain—its power subordinated to the Supreme Commander. In Korea, however, things would be different, for the Korean government was controlled and directed by Japanese who would be removed from office at the earliest opportunity, at which time other individuals must be prepared to step in and take up the reins. The situation could be likened to a stage coach with its team of horses from which the driver has suddenly been removed, while the coach is in motion. It immediately becomes imperative to find another driver, and the XXIV Corps was facing a situation where there were no drivers. Among the Koreans there would be very few individuals qualified to assume high governmental offices for the Japanese had consistently denied the Koreans any such opportunities for thirty-five years. American military government schools had trained no people for duty in Korea. Their facilities were already taxed to produce trained personnel for Europe and for the anticipated invasion of Japan. Who in the early part of 1945 foresaw the collapse of Japan? Yet the job had to be done. From military government personnel on Okinawa, three provisional military government companies were thrown together, while three group headquarters units and eight companies in the Philippines were added to the corps troop list. A planning staff which had been working at Tenth Army headquarters was given to the corps and finally, the Headquarters and Headquarters Battery, Tenth Army AAA, was made available. Over-night, this battery, headed by a brigadier general, became the corps military government section and it was the nucleus from which grew the organization that stepped in and operated the government of Korea under the direction and supervision of the corps commander.

Preliminary Moves

In the face of all of these obstacles, planning and preparation proceeded at a fever pitch. Time and shipping limitations prevented the lifting of any elements in the Philippines area, and the

initial echelon was limited to the corps headquarters, part of the corps troops, the 7th Infantry Division, and part of the Ascom 24 service troops—all of which were on Okinawa. On 1 September, an Okinawa-based B-24 dropped leaflets over Seoul and Inch'on announcing the early arrival of the American troops. The same mission was flown again on 5 September, and on both occasions the pilots reported enthusiastic signs of welcome from the Koreans.

Also on 1 September 45, communication was established between the corps headquarters and the Japanese commander in Korea. To do this it had been necessary for the corps commander on Okinawa to make his request to the theater headquarters in Manila. There the request was approved and transformed into a directive sent by radio to the Imperial General Staff in Tokyo and thence relayed to the Japanese general in Korea. By this devious procedure and after many patient hours of transmission and waiting, contact was made with Lieutenant General Yoshio Yokozuki, commanding the 17th Army Group in Korea. With him, arrangements were made by radio to send an advance party of twenty-eight officers and eight enlisted men to Seoul. The party left Okinawa on 4 September in B-25s carrying from the corps headquarters the deputy chief of staff, three members of the military government section, and representatives from the G-1, G-2, engineer, signal, surgeon, and provost marshal sections: four representatives from the 7th Infantry Division, and three representatives from Ascom 24. Only one of the planes made it through the adverse weather, but the others returned safely to Okinawa and made a second successful try on 6 September.

Meanwhile loading operations had been in full swing, and on 5 September the convoy, consisting of twenty-one large vessels and six small transports, sailed from Buckner Bay (Okinawa) for Korea. For more than a week, Seventh Fleet units had patrolled the waters off Korea while mine sweepers had cleared the entrance to the Yellow Sea and the approaches to Inch'on. The voyage was uneventful until the convoy reached the Inch'on channel entrance where a Japanese picket boat with twelve harbor pilots arrived on schedule to guide the convoy through the maze of passages. Also on schedule, designated members of the advance party, together with representatives of the Japanese commander, sailed down the channel and boarded the command ship. Not expected, however, was a trio of Koreans who had spent the night in an open boat to come aboard the command ship and present their briefs and thus become the first seekers of power and privileges from the occupation forces.

The convoy finally reached Inch'on about noon. H-hour had been set for 1500, determined by tide conditions which had a 30-foot variation, but on arrival it was found possible to move the hour forward to 1430. At that time on 8 September 1945, elements of the 7th Infantry Division landed unopposed in any way and the occupation of Korea had begun.

An Inventory of

Prerequisite Military Knowledge

Jacob S. Orleans, Ph. D., Psycho-Educational Advisor,
Command and General Staff College

ADMISSION to the Command and General Staff College theoretically assumes completion of an advanced branch school, or the equivalent thereof. The class that entered the College in September 1946 is made up to a large degree of student officers who have been granted constructive credit for completion of the course of an advanced School, and, in an appreciable number of cases, of the course at the Command and General Staff School as well. This condition is a direct outcome of the war period. Many of the students have had a great deal of specialized experience. By the same token it was expected that many might be deficient in much of the military knowledge prerequisite to the learning of the regular course of the College.

In order to determine the extent to which this assumption was a reality, an Inventory Test was prepared and administered to the first class of the Command and Staff College on 4 September 1946, the second day of the new College term. The results of such a test can also serve the following purposes: determination of students who are in need of guidance early in the course with a view to correcting deficiencies in prerequisite knowledge; information for the several schools of the College concerning the extent to which lack of prerequisite knowledge should be taken into account in the teaching of various topics; possibility of the contribution of results of the test to the prediction of student academic success in the course.

The test consists of 215 multiple choice questions, fifty each in the areas of personnel, intelligence, and logistics, and sixty-five in operations and training. Although the test was intended to measure the extent of prerequisite knowledge on the part of student officers, some questions were included that would not fall in that category. This was done in order to produce as much variation as possible among the students who obtained the highest scores.

It should be mentioned that the test was prepared during the weeks prior to the opening of a reorganized college, when the faculty was still incomplete and its members were burdened by a multiplicity of responsibilities related to the preparations for teaching a new course. Furthermore, the experience of preparing a test of the type decided on was a relatively new experience for the members of the faculty to whom the task was assigned. The data presented below justify the contention that, despite the defects in the test that necessarily resulted from the conditions under which it was prepared, it is a good type of test, and that this testing procedure gives promise of having real value for the educational program of the College.

The objective form of question was used in order that the scoring require a minimum of time and effort. As a result, the

questions did not ask for creative activity. They demanded that the student recall, recognize, be able to select from several choices, and in some cases make judgments. Failure on questions calling for such mental activity is likely to be more significant than lack of ability in creative tasks. The results of the test are presented in the distributions of scores, not including the data for allied officers who are students at the College. (Table 1).

It is apparent that the students vary very widely in their possession of the knowledge prerequisite to learning the regular course offered by the College, as indicated by the sampling of such knowledge covered by the test. It is also apparent that the dispersion was large among the students near the top of the distribution, despite the fact that the highest score obtained by any student is forty-four questions short of the maximum possible score. In other words the purpose of the test could have been achieved without those questions that are not in the category of prerequisite knowledge.

One phase of the course, comprising ten weeks of instruction, is devoted to specialization in one of the four schools. Each student is administratively assigned to a school when he receives his assignment as a student at the College. All students take the same common course, except for the specialized instruction. For administrative and guidance purposes the student is under the aegis of the faculty of the school to which he is assigned. Because of this arrangement it is of interest to determine the

Distribution of Scores on the Inventory Test
Number of Students

Score	*School of Personnel*	*School of Intelligence*	*School of Combined Arms*	*School of*	*Total*
170			1		1
165			1	1	2
160		1	0	2	3
155	1	3	3	1	8
150	2	4	5	2	13
145	1	3	10	1	15
140	5	6	17	4	32
135	6	3	11	5	25
130	7	10	6	9	32
125	5	7	9	5	26
120	4	8	9	13	34
115	8	9	3	5	25
110	6	2	3	4	15
105	3	1	3	3	10
100	1	1	0	1	3
95	1	0	2	0	3
90	0	0		3	3
85	0	1		1	2
80	0	0		0	0
75	2	0		1	3
70		0			0
65		0			0
60		0			0
55		1			1
Total	52	60	83	61	256
Mean	124.4	129.3	134.9	124.8	129.2
Standard Deviation	16.8	17.4	15.3	17.0	17.0

Table 1.

	Personnel	*Combined Intelligence*	*Arms*	*Logistics*	*Total*
Number of Questions	50	50	65	50	215
Mean Number Right	31.3	28.1	42.1	27.6	129.2
Per cent Right	62.6	56.2	64.8	55.2	60.1

Table 2.

distributions of the total scores on the test for the students in each school. There is evident both large differences in average scores among the several schools and among the students within each school.

What is the extent of the prerequisite knowledge of the students in various subject matter areas? The answer to this question is indicated by the data in Table 2.

The knowledge of items in operations and training and in personnel as sampled in the test was possessed by the students to a somewhat higher degree than the knowledge of the items in intelligence and logistics. The differences are not very large. A more detailed analysis was made by dividing the content into more limited categories. These categories with the number of questions under each, and the number and per cent answered correctly are given herewith. It will be noted that the total is greater than 215, a phenomenon produced by the fact that some questions were included in more than one category (Table 3). The per cents right lie between fifty per cent and seventy per cent in almost every area except intelligence staff duties (26%), Supplies (44%), transpor-

Subject	*Number of Questions*	*Number Right*	*Per cent Right*
Command	35	20.1	57
Staff	85	54.4	64
Organization	53	30.5	58
General	44	24.3	55
Personnel			
Staff Techniques	20	11.9	60
Manpower Utilization	6	4.0	67
Personnel Management	12	7.5	63
Estimates, Plans and Operations	12	7.2	60
Intelligence			
Command	18	9.3	52
Staff Duties	38	10.0	26
General	22	12.0	55
Combined Arms			
Organization	10	5.5	55
Map Reading	11	9.3	85
Command	8	5.0	63
Tactics	7	3.8	54
Training and Technique	29	17.6	61
Logistics			
Supplies	18	8.0	44
Evacuation and Hospitals	7	4.0	59
Transportation	10	4.3	43
Services	10	5.6	56
Management	10	5.1	51
Combat Zone	9	5.5	61
Communications Zone	16	8.6	54
ZI and WD	10	4.6	46

Table 3.

tation (43%), ZI and WD (46%), and map reading (85%). It should be noted, however, that in several of the categories the number of questions is too small for the findings to be considered as truly indicative. The nature of the content covered by the questions is also a factor in interpreting these findings.

The following tabulation (Table 4) shows the distribution of the difficulty of the questions. Most of the questions appear to be relatively easy, as shown by the fact that eighty-eight of the questions were answered correctly by at least seventy per cent of the students and 112 questions (more than half of the total) were answered correctly by at least three-fifths of the students. The ideal situation would be for almost all the students to answer almost all the questions correctly. That

Per cent Right	*Number of Questions*
90-100	30
80-89	27
70-79	31
60-69	24
50-59	23
40-49	30
30-39	21
20-29	16
10-19	6
0-9	7

Table 4.

outcome would show a high level of possession of prerequisite knowledge by virtually the entire student body. If an inventory test of prerequisite knowledge is a valid test and the prerequisite knowledge of the students is of a high order, a large percentage of the students should answer most of the questions correctly. This desideratum is different from a test used for administrative purposes by means of which it is desired to differentiate as accurately as possible among all the students. Such a test should consist of relatively few very difficult and very easy questions and increasing numbers of questions approaching average difficulty.

As illustrations of the significance of the findings may be mentioned that from two-fifths to three-fifths of the students did not know that the provost marshal of an infantry division is a commander as well as a special staff officer; that the initial issue of shoes to troops fall into Class II; that the preparation and issue of the station list for units assigned or attached to a command is a responsibility of the adjutant general; that company aid men should evacuate casualties incurred by an infantry company in an attack; that the provost marshal is the officer responsible for traffic control in a division.

A further analysis of the test results was made on the assumption that some of the questions might be faulty and should not be considered as part of the test. It would be most unusual if such were not the case, particularly in view of the conditions under which the test was constructed. Expert test constructors, in the preparation of an objective test, usually try out the questions that they plan to use in order to eliminate those questions that for one reason or another turn out to be unsatisfactory. The criterion chosen in this instance was the relative difficulty of each question for those students who obtained the highest scores and those who obtained the lowest scores. The twenty-five student officers who stood highest on the test had scores of 150 or more. The twenty-five student officers who stood lowest on the test had scores of less than 110. The average of the scores of the former was 156.8 and of the latter 96.2. It is assumed that where so large an average difference exists between the two groups (about three-fifths of the entire range of scores) the per cent right on any question should be appreciably higher for the twenty-five students with the best scores than for the

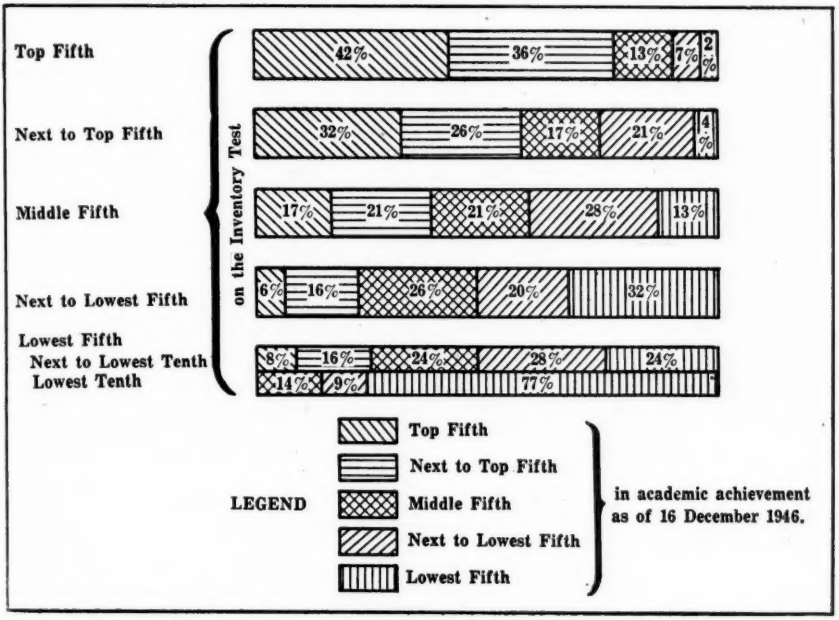
twenty-five students with the lowest scores.

These per cents were computed for each question. It was found that in the case of twelve questions the per cent right was higher for the twenty-five students with the lowest scores than for the other group, and in the case of eleven other questions the per cent right was the same for the two groups. The papers were then rescored, omitting these twenty-three questions.

How indicative are scores on this test of probable success in academic achievement? To answer this question the coefficient of correlation was computed between scores on the test and average grade upon completion of Phase II (The Combat Zone) of the course. The correlation between the original scores (based on 215 questions) was .54. When the corrected scores were used it was found that the correlation had changed to .62. The significance of this correlation is shown in the following chart.

The test in its present form is far from being an accurate predicter of level of academic achievement. It apparently provides as good a prediction as does, for instance, a comprehensive achievement test or a test of academic ability or both in predicting average achievement in first year college work. However, the results obtained to date give promise that a test prepared with greater care than was possible in this first attempt is likely to provide a degree of accuracy of prediction that may make it a valuable instrument.

Interpretations of the data are some-



Percentage of Students in Each Fifth (and lowest two tenths) on the Inventory Test Falling in Each Fifth in Academic Achievement at the End of the First Four Months.

what complicated by the inclusion among the student body of several students who, having been prisoner of war in the Philippines or Japan for a period of four years, could hardly be expected to give true evidence of their prerequisite knowledge, and who at the same time would need a period of adjustment in order to get into the swing of the work. There are also a number of specialists whose background is likely to be especially limited. Although the number of these special cases is not very large, they may affect the interpretations to some extent.

During the next several years, the Command and General Staff College may expect that the composition of its student body will be similar to that of the current student body. Perhaps not until 1951 or 1952 will the present officer-education program of the Army have its full effect on the educational background of the student officers assigned to the Command and General Staff College. In the meantime, the results of the inventory test can be employed to select students whose background military knowledge is deficient in one respect or another. These students can then be provided with the guidance they need to help them correct their deficiencies. The faculty can take into account deficiencies revealed, particularly in their treatment of topics in the earlier stages of the course. And if modifications of the test can improve its predictive accuracy to a sufficient degree, it may be usable as added information in screening officers who are prospects for assignment as students at the college. This last point takes on particular significance in view of the large number of officers who are eligible for such assignment in comparison with the number of available spaces.

We know this; modern war calls for the total mobilization of all men and all energies. We know, too, that we are not likely again to be given two years or more by heroic Allies to get ready. Next time—if there must be a next time—we are likely to be the first target.

On short notice, each man must be ready to take his place and go forward —not at the end of a few months, or a few years, but immediately. Otherwise it may be too late.

President Harry S. Truman

Joint Operation Aspects of the Okinawa Campaign

Lieutenant Colonel Walter Killilae, *General Staff Corps*

This is the second of three articles on this subject by Colonel Killilae. It supplements an article which appeared in the June 1947 edition of the MILITARY REVIEW. The third and last article will appear in a subsequent edition.—The Editor.

Tenth Army Planning Phase

THE theater comprising the Pacific Ocean Areas was, in October 1944, a theater in which the Navy had primary interest and was under the command of the Commander in Chief, Pacific Ocean Areas (CINCPOA). In order to facilitate Army matters in the theater CINCPOA had set up an army headquarters known as U.S. Army Forces Pacific Ocean Areas. Prior to "Operation Iceberg," Tenth Army was a part of that force. During the operation it formed part of a joint task force under navy command, and prior to the conclusion of the combat phase of the operation was designated as a major command echelon immediately under theater headquarters, subsequently Tenth Army passed to the control of General MacArthur.

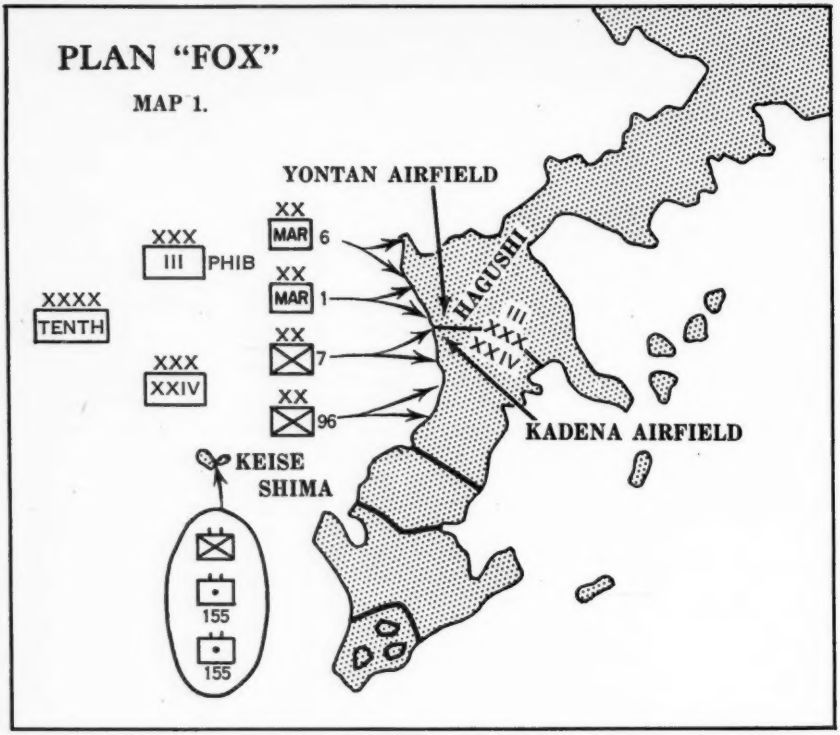
The tasks to be accomplished by the expeditionary forces were analyzed as follows: first, they were to capture, occupy, defend, and develop Okinawa Island and establish sea and air control on the Nansei Shoto. Second, they were directed to extend that control by capturing, occupying, defending and developing additional positions in the Nansei Shoto.

These two tasks formed the basis for the phasing of "Operation Iceberg." Phase I was to include the southern half of Okinawa. Phase II, the remainder of Okinawa plus the adjacent island of Ie Shima. Phase III was to be the capture of additional islands required to extend sea and air control of the Nansei Shoto.

These tasks and the command position of the Tenth Army can be reconciled. During the planning phase, while under U.S. Army Forces Pacific Ocean Areas, Tenth Army was delegated a major portion of the army responsibility for tactical and logistical planning, and was authorized to communicate directly with navy fleet and service headquarters, marine force headquarters and the army supply services in the theater, as well as with the navy theater commander's headquarters. Emphasis was on the coordination of planning.

During the operation, Tenth Army exercised control over ground and service troops, including marine units. There, of course, the emphasis was on the words *capture* and *occupy*.

At the completion of the amphibious phase of the operation, when Tenth Army was to come under direct control of the theater commander in its capacity as Task Force 99, the emphasis was to shift once again; this time to development and to sea and air defense. In these tasks the Commanding General, Tenth Army, was to have combat, service, sea and air units of both services under his control.



Development of the Tactical Concept

Advance information of the operation was received by Tenth Army on 9 October 1944, and the next day a formal directive arrived from CINCPOA directing that Tenth Army participate as the expeditionary troop headquarters in "Operation Iceberg." The target date (L-day) was initially stated as 1 March 1945.

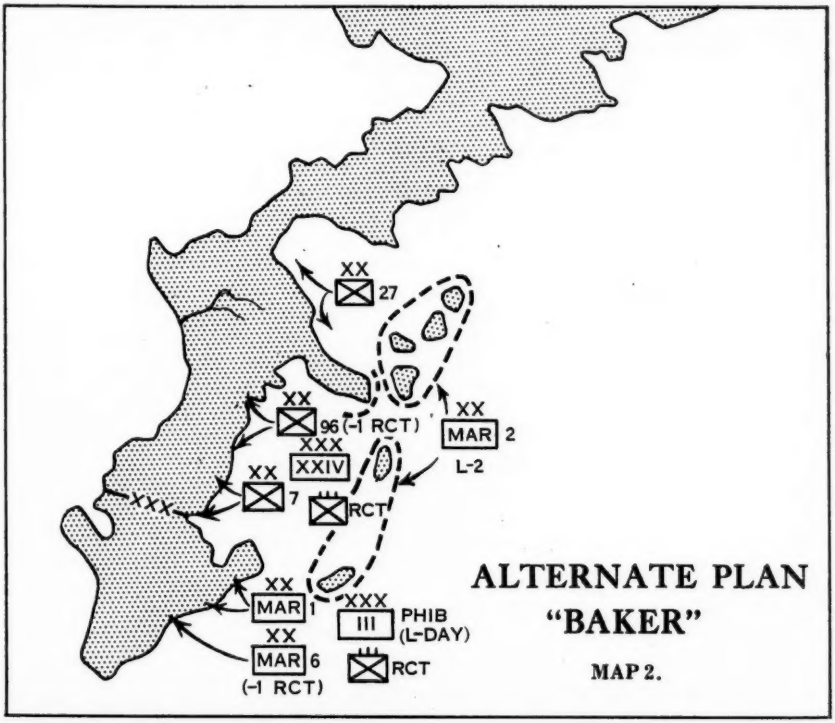
The objective was analyzed and six possible courses of action, were drawn up. All plans were presented to the Commanding General on 28 October 1944 and plan "Fox," shown on Map 1, was selected as the preferred plan. This plan was considered the most feasible because the beaches north and south of Hagushi on the west coast of the island were the best available and the assigned task of capturing or building two air strips by L+5 was most likely to be accomplished in this area,—for here it was known were the Jap built Yontan and Kadena airfields.

The first conference with the Commander, Expeditionary Force and his staff was held on 1 November 1944. At that time plan "Fox" was presented with plan "Baker" as an alternate. Plan "Baker" contemplated landings on the eastern and southeastern beaches, as shown on Map 2. The relative merits of these two plans can be seen at a glance,—except that the beaches and topography are not apparent. The beaches shown in plan "Baker" are definitely inferior to those shown in plan "Fox." This fact will be brought out later.

There are practically no covered exits available from these beaches, and the terrain rises rather sharply immediately beyond the dune line reaching 1,000 feet in the central Chinen hill mass. As a matter of fact, in the rugged hills in the Mabuni-Makabe area where the Japs made their last do or die stands, the terrain was too rough for even the typical Jap suicide charges.

Both plans contemplated the capture of off-shore islands for the emplacement of artillery to supplement naval gunfire support on the landing areas, and to provide immediate artillery support for ground units.

At the initial conference the Commander, Joint Expeditionary Force brought up two factors in connection with these plans. One was a rather serious objection and the other was a suggestion. The objection was that from a naval point of view the waters on the west coast of Okinawa were restricted, and offered great hazards to our shipping from enemy mines and submarine action. Further, it was doubtful if four assault divisions and the necessary corps and army troops could be landed and supported from an open roadstead, particularly in view of the unfavorable weather and sea conditions usually present on 1 March in that area. The suggestion presented was that a demonstration landing, or feint, be considered. The conclusions of the conference were that landings on the west coast of Okinawa



would be extremely dangerous in March 1945. Alternatives to the preferred plan were that landings be made on the southeastern beaches or that the operation be postponed at least thirty days. The immediate result of the conference was that Tenth Army was directed to reanalyze the feasibility of landings on the southeastern beaches.

In compliance with that directive, Tenth Army concluded a staff study on 9 November which stated that the Hagushi beaches were the only beaches on the southern half of Okinawa, adequate to take an assault force of four divisions and handle sufficient tonnage of supplies to sustain them in combat.

The Commander, Joint Expeditionary Force, accepted those conclusions and on 11 November the plan was agreed upon.

It was plan "Fox" modified by the addition of two changes. First, the pre-L-day capture of the Kerama Retto, providing a fleet anchorage and repair base as well as rendering shipping on the west coast of Okinawa less vulnerable to enemy mining and submarine activities, and thereby meeting the objection to the original plan "Fox." Second, the suggestion of staging a feint was also included. The previous conclusion that March landings on the west coast of Okinawa would be dangerous was still only partially answered, and both staffs were aware that this was to be a tough assignment.

The pre-L-day landing in the Kerama Retto presented a problem in the allocation of troops. The major units available to Tenth Army for the operation were: XXIV Corps with the 7th, 77th and 96th Infantry Divisions (to be made available upon the completion of the Leyte Operation); and the III Marine Amphibious Corps composed of the 1st, 2d and 6th Marine Divisions. In addition to these two corps, the 27th and 81st Infantry Divisions were designated as area reserve divisions. The designation, area reserve division, meant that they would not leave their rehabilitation areas at Espirito Santo and New Caledonia respectively unless specifically released by the theater commander.

It was originally estimated that all three divisions of the III Amphibious Corps would be required for their part in the operation, because the Japs were believed to be particularly well emplaced on the northern beaches and the area behind those beaches. Inasmuch as one division was now to be used as a demonstration division on the east coast, it was estimated that an additional division was needed as floating reserve for the Army. The 27th Division was, therefore, at the request of Tenth Army, released from its status as an area reserve division and was designated as part of the Tenth Army floating reserve. The 77th Infantry Division,—another portion of the floating reserve—was assigned the task of conducting the pre-L-day operations in the Keramas.

Re-examining the troop list we find the following situation:

Of the five echelons shown under Tenth Army, we are now concerned with only three, as the naval forces and the Tactical Air Force did not come under Tenth Army control until later.

The 77th Division is listed as one of the ground combat elements because, as will be pointed out, it operated as a separate force, in addition to being available as a reserve division. The Island Command (ISCOM) was a headquarters to which were assigned the bulk of the army service troops. It was similar to the ASCOM used in the Leyte Campaign. Except for the fact that it would not operate under Communications Zone it might be likened to the advance section organization found in the European Theater.

In addition to the preferred plan and the alternate plan, each of the reserve divisions was directed to prepare plans for:

(1) The capture of Ie Shima.

(2) The reinforcement of the III or XXIV Corps.

(3) The capture of the eastern islands in Chimmu Wan and Nakagusuku Wan.

(4) The landing over the eastern beaches to support the XXIV Corps.

Planning for Phase II was instituted as early as possible after the planning for Phase I was initiated. Phase II contemplated the capture of the northern half of Okinawa, as well as the capture and development of Ie Shima.

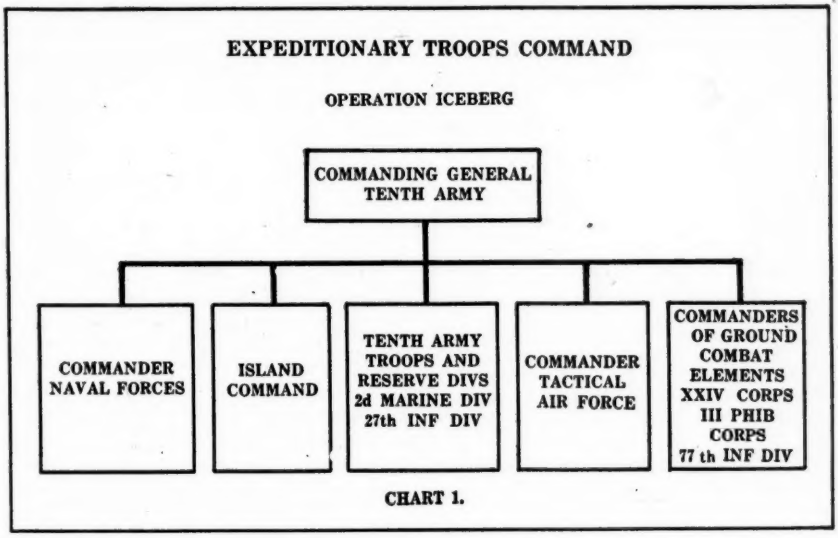

EXPEDITIONARY TROOPS COMMAND
OPERATION ICEBERG
COMMANDING GENERAL TENTH ARMY
COMMANDER NAVAL FORCES
ISLAND COMMAND
TENTH ARMY TROOPS AND RESERVE DIVS 2d MARINE DIV 27th INF DIV
COMMANDER TACTICAL AIR FORCE
COMMANDERS OF GROUND COMBAT ELEMENTS XXIV CORPS III PHIB CORPS 77 th INF DIV

CHART 1.

Phase III planning was begun prior to the time Tenth Army left Oahu and encompassed the capture and development of some five additional islands in the Ryukyus. These plans were changed several times, and actually only one of the islands originally scheduled for Phase III was ever taken,—and that with practically no enemy opposition.

Logistical Planning

In the planning for every Pacific operation several factors were of exceptional importance,—they were:

(1) Availability of troops required.

(2) Availability of supplies, equipment and materials required.

(3) Availability of shipping required.

(4) Beach capacities,—that is the tonnage discharge rates.

(5) Time and space,—particularly as they affected mounting dates and transportation.

These factors, all except the first,—troops available,—are logistical considerations. They controlled any tactical planning.

Analysis of the joint staff study previously referred to disclosed two separate but related logistical missions. First, the support of the assault troops, and second, the development of the area as an advance air and fleet base and as a mounting area and source of reserve supplies for future operations.

Logistical planning for "Operation Iceberg" chiefly involved four tasks: First; arrangements for, and procurement of, the initial supplies and equipment, and the allocation of the shipping necessary to get it to the combat units in their mount-

ing areas. Second; allocation of shipping to assault units for their movement from mounting areas to the target, as well as the allocation of shipping for the preliminary movement of certain troops and cargo to the assault units in their mounting areas. Third; scheduling of garrison troops and equipment and base development materials from West Coast Ports, Oahu, Leyte, the Marianas, and New Caledonia to the target area to support the assault and meet the base development schedules. Fourth; procuring the maintenance supplies on the West Coast of the United States, 6,250 nautical miles and twenty-six days sailing time from the target area, and integrating the arrival of those supplies in accordance with the estimated build-up of population and the expenditure and consumption rates estimated.

On 27 October 1944, G-4 Tenth Army published a memorandum entitled "Logistic Implications of Operation Iceberg." That document formed the basis for future planning. Its principal points were:

(1) That except for ammunition supply, the methods of supply set forth in the joint staff study would support the operation.

(2) That assault shipping available was sufficient to lift only six divisions and 45,000 corps and army troops with their minimum organic equipment and initial maintenance cargo.

(3) That additional corps and army troops would be required to support the operation, and would have to be landed subsequent to the assault troops.

(4) That the Hagushi beaches were the only beaches on the southern half of Okinawa capable of handling sufficient tonnage to land and maintain two corps with their supporting troops.

(5) That the daily unloading average possible over the Hagushi beaches was not sufficient to maintain the unloading schedule required for base development materials, and that additional beaches must be secured at an early date.

Supply Arrangements

The initial preparation of requisitions for supplies and equipment to be included in maintenance and resupply shipments was begun by the several supply services about 20 October 1944 and submitted to the West Coast supply agencies by 20 November 1944 to meet the 1 March 1945 delivery date at the target.

Chart 2 shows the time and space factors that played such an important role in the planning and requisitioning of maintenance supplies. The elapsed time of 120 days made it necessary to forecast population build-up requirements, and presented many difficulties as troop lists and tactical plans were not firm until a relatively late date in the planning sequence. Army and navy requisitions were prepared to contain predetermined amounts of supplies to cover a given number of days of supply for type units. The term 'block requisition' was applied to this procedure. The use of these block requisitions facilitated requisitioning supplies for all shipments as the blocks submitted with the original requisitions established standard units. The system also facilitated loading and made selective calling forward and discharge easier.

Marine units used separate requisitions for each of their shipments and did not follow the army system of blocks, claiming that the flexibility possible in requisitioning separately for each shipment more nearly met the actual conditions, prevented the unbalancing of supplies and was worth the additional paper work.

The Tenth Army was charged with the coordination of the details of loading maintenance shipments. These shipments were set up for West Coast departure and were scheduled for arrival at the target area at ten day intervals. This coordination included the allocation of space on all ships assigned by CINCPOA for army, navy and marine resupply.

Cargo distribution plans were prepared and forwarded to the ports of embarkation

at the same time that the requisitions were submitted. Many last minute changes to these plans were handled by teletype direct with the ports concerned.

Twenty-one maintenance and resupply shipments were set up to provide automatic arrivals of supplies until L+210. They were designed to provide maintenance for the assault and garrison troops as well as to build up the reserve for the base.

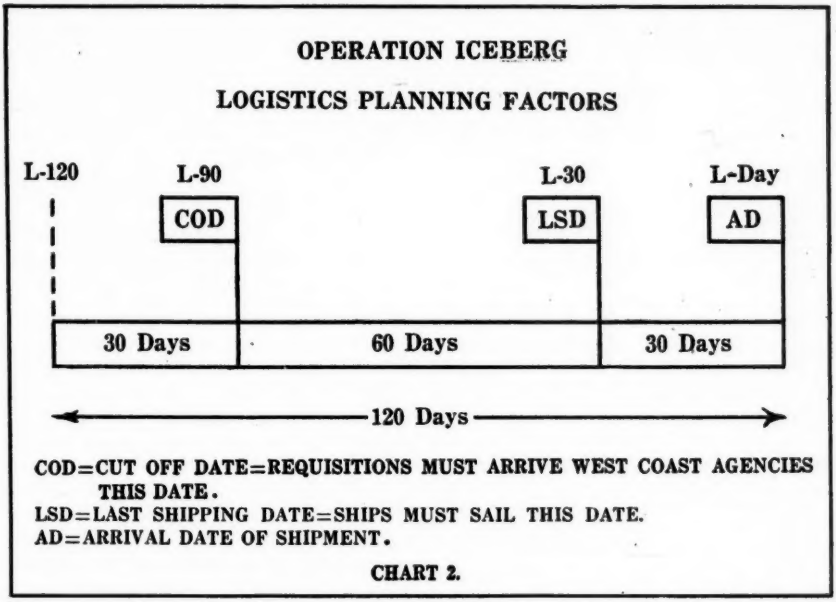


CHART 2.

After L+210, Class I supplies were to be furnished on an automatic basis in accordance with strength returns and the monthly inventory of subsistence on hand. ISCOM, Army's supply agency, was to requisition other classes of supply as required.

Tenth Army Operations

In accordance with plan "Fox," modified, the Ryukyus operation began on 26 March 1945 when five islands of the Kerama Retto were taken by the 77th Infantry Division. Three of the islands were quickly overrun on the first day of the operation and moderate resistance was met on the other two. On the following day three additional islands in the group were assaulted and by 1600 two of those were declared secure and fighting had ceased on one of the islands not cleaned up the previous day. By 29 March all islands of the Kerama Retto were in our hands and the 77th Division reported that it was ready for another task. Thus the first portion of the pre-L-day operations had gone off successfully and the naval forces had a safe anchorage west of Okinawa. The second part of the pre-L-day operations was equally successful when artillery was emplaced on the island of Keise on 31 March.

Underwater reconnaissance, demolitions and minesweeping of the Hagushi beach area having been accomplished the Commander, Expeditionary Force announced that final preparations and prospective weather conditions were such that landings

would be possible on 1 April. Tentative H-hour was set at 0830...

April 1 dawned with cloudy to clear skies, moderate winds, negligible surf and a temperature of 75 degrees. In short, a perfect day for the job at hand.

Over 1,300 major naval units had converged on Okinawa during the night. The transport squadron carrying the 2d Marine Division was in position off the southeastern coast, prepared to execute the planned feint landings. Small fire support craft moved in close to the beaches, while larger fleet units stood off shore and steamed back and forth along the assault beach areas. All were firing on pre-arranged targets. Carrier based aircraft were aloft to intercept enemy planes attempting to enter the area and two groups of sixty-four marine fighters each were orbiting over both ends of the beach areas. Off each landing beach, control craft formed assault waves of amphibious vehicles into rotating circles. At 0815 H-hour was announced as 0830, and at that hour an almost continuous eight mile line of armored and troop carrying amphibious vehicles swept toward the beaches. The troops of that first wave and the waves that followed met scattered, light resistance ashore. Initial progress was very good,—so good, in fact that both Yontan and Kadena airfields were captured by 1300 that day.

This progress continued. Units of the XXIV Corps reached the eastern coast on L+1 and the corps turned southward. The 2d Marine Division executed another feint landing on the southeastern coast again that day, while the III Amphibious Corps pushed northeast across the island reaching the east coast on L+2. By the following day that corps had completed Phase I of the operation in its zone of action—Yontan airfield had been repaired and was ready to receive emergency landings,—the expeditionary troops had taken an area fifteen miles long and three to ten miles wide.

During the first few days of the operation, underwater reconnaissance was conducted on the east coast with a view of determining the advisability of additional landings on that coast. Remember that the beaches at Hagushi were limited. Reef and beach conditions, however, were found very unfavorable, and as an alternative to east coast landings, the 27th Division in floating reserve was called upon to take the eastern islands. During the period 8 to 11 April all five of these islands were secured and the east coast waters were available for use by close-in naval gunfire support ships.

Back on Okinawa we find the situation on 5 April as follows. The XXIV Corps had reached the Macinato line, and the III Amphibious Corps was at the northern end of the Isikawa Isthmus.

The Macinato line was to the first of three formidable defensive positions occupied by the Japs on Okinawa. The XXIV Corps smashed at that line with most of three divisions for eighteen days before the key positions at Hills 178, 143 and Kakazu fell on 24 April.

While the XXIV Corps was bogged down in the south, other units were doing much better. The 77th Division launched an assault against Ie Shima and completed the capture of that island on 21 April after a five day campaign. The III Amphibious Corps had proceeded north, and by this time all organized resistance in the northern half of Okinawa had ceased, further action being limited to patrols. Thus Phase II of "Operation Iceberg" was completed by L+21, considerably ahead of Phase I. At least the plans had been flexible.

After finally breaking the Macinato line, XXIV Corps almost immediately encountered the second strong Jap defensive position,—the Shuri line. Prior to attempting to assault the Shuri line a regrouping took place. The badly battered 27th and 96th Divisions were taken out of the line and replaced by the 77th and the

1st Marine Divisions. While this regrouping was taking place a series of coordinated air, sea, and land counterattacks were launched by the Japs. None was successful in any appreciable degree, but did cause considerable local damage and delayed final preparations for a full scale assault against the Shuri positions.

By 11 May, Tenth Army was ready to launched an assault with two corps of two divisions each, with one division in army reserve and another, the decimated 27th, patrolling the northern portion of the island. The remaining division to be accounted for, the 2d Marine, had been returned to Saipan. It was not required after its two feints at the southeastern beaches, although we shall hear more of one of its Regimental Combat Teams later.

The plan for the assault on the Shuri line called for continuing pressure against the center while attempting a double envelopment, committing the army reserve division, the now partially rehabilitated 96th, on the east coast, once the Jap flank had been turned. The flank was turned by the 7th Division on 21 May and the 96th was committed, but full advantage of the turning movement could not be taken due to an extremely bad turn in the weather. Almost continual heavy rains during the period 21 to 31 May bogged down operations and made the clay and coral roads practically impassable. All the roads on the east coast were flooded, and it was impossible to supply all the units adequately by the west coast and center island roads. This consequent lack of supplies further handicapped the muddy doughboys in their attempt to advance against the Jap cave positions.

As soon after the weather cleared as possible, the assault picked up momentum and by 3 June the Shuri positions had been completely overrun. The east flank units had sealed off the Chinen peninsula, and were pushing southward. The Marines on the west coast who had first entered Naha on 12 May finally completed the occupation of that completly shattered port city.

In an attempt to speed up the completion of the operation one marine division launched an amphibious assault against the Oroku peninsula while the other pushed south to encircle the Japs caught in the pocket thus formed. The XXIV Corps continued to push southward with its two remaining divisions—the 77th having at last been relieved and re-embarked for the Philippines.

The Marines completed their action against the Oroku peninsula on 12 June, after the corps was reinforced by the 8th Regimental Combat Team of the 2d Marine Division. That Combat Team had been re-embarked out of Saipan, and had taken three other islands in the Ryukyus in the interim. On 13 June, Tenth Army launched another coordinated attack with two corps. This time against the last Jap defensive line,—the Uaeju-Dake line where the remaining Japs were assisted by the best defensive terrain, and where their finest emplacements were built. Eight days later, at 1305 on 21 June, the island was declared secure—there was no more organized resistance on Okinawa. Mopping up operations, however, continued in the southern end of the island for some weeks thereafter.

Logistical Operation

An attempt has been made to show how the tactical plans were followed or revised as the situation developed, and now, turning to the logistical situation let us see if the logistical planning succeeded in drawing up a plan that: (1) supported the assault troops, and (2) provided for development of the area as a base for future operations.

First, on the shore party operations at the Beaches and Ports.

In general, the progressive passage of shore party control from battalion to regiment to division, corps, and army proceeded according to the usual pattern.

By 9 April ISCOM (Island Command) assumed control of all shore party activities for the army on the west coast except for the beach area at Nago where the III Amphibious Corps operated its shore party independently. ISCOM designated the 1st Engineer Special Brigade,—which had had similar experience in Africa, Sicily, Italy and Normandy as its agency to control the shore operations. The Navy retained control over the actual unloading of the ships. Except for two floating ponton causeways, all unloading was done by means of DUKWs, LCVPs, ponton barges, LCTs and LCMs operating as lighters. As was typical of nearly every other joint phase of this operation there was no friction between the Army and Navy in this task.

The Engineers continued beach operations until 31 May when responsibility was delegated to the Commander, Naval Operating Base Okinawa, another ISCOM agency.

The early start and unexpected rapidity of the completion of Phase II, together with the prolonged assault in the south, caused some radical changes in the beach and port program. Some of the planned sites were found unsuitable, unavailable, or were not needed. On the other hand, other sites not previously counted on were developed. Of the fourteen planned beach and port areas, five were never used, while nine others were operated. Personnel and cargo were unloaded from seventeen port and beach areas on Okinawa.

All the assault unloading proceeded according to plan. Ninety-nine per cent was unloaded by 15 April. Post-assault unloading during the period 15 April-5 May kept ahead of previously estimated discharge tonnage rates. From then until the end of the operation the unloading schedules were not met. In fact, they fell behind consistently, due perhaps to the importance that the logistical planners had placed upon the relatively early use of the port of Naha, which incidentally, even after it was opened did not meet expectations due to the vast amount of damage caused by naval gunfire and land artillery. This, no one had anticipated, although damage from air attacks had been rather carefully estimated. Another factor partially responsible for the lag in unloading schedules was the necessity for early and priority unloading of ammunition ships during the entire month of May which caused delay in unloading other cargo. This failure to keep up with the unloading rate caused a pile-up of shipping awaiting discharge.

The problem of resupplying the assault units, like all other problems, was complicated by the rapid advance in the north, the slow-down in the south, and the heavy rains during the assault on the Shuri line. In accordance with plans, supply responsibility ashore passed smoothly from divisions to corps and then to ISCOM acting as an army supply agency. The 1st Engineer Special Brigade operated supply depots and dumps until 19 April when ISCOM assumed direct control over its supply facilities. The resupply stocks in the block requisitions were, except for ammunition, adequate. The principal difficulty in effecting resupply lay in the discharge of ships and in distributing the supplies after they were ashore. Reasons for these difficulties have been expounded *ad infinitum* . . . Beaches . . . Weather . . . Japs.

Planning the Precision Incendiary Bomb Attack

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In each war new techniques are developed, but the problem of reducing them to a science is often necessarily delayed until time for considered thought is available to the military mind. During the recent war, scientists, both civilian and military, worked to record the many effects arising from the employment of these new techniques. Incendiary raids on enemy cities were gradually brought to a high pitch of intensity and efficiency until they produced great property damage and contributed to a great extent in reducing the will and capability of the enemy to resist.

At the beginning of World War II we were impressed by the radio and press with the high degree of accuracy of our "secret" bomb-sights. Results in early operations did not come up to expectations, and later operations were conducted without the "barrel-head accuracy" which was anticipated from our first attempts at bombing enemy objectives from high altitudes by very heavy bombing formations. The technique of incendiary bombing was, therefore, developed to utilize a potent munition on an area basis to produce widespread destruction of enemy cities.

The development of very heavy bombers, incendiary bombs, and of fire fighting techniques advanced very considerably during the war. The planning of raids to overcome the enemy's fire fighting techniques brought out very interesting principles of fire raising, and the successful application of these principles was enough to overcome the fire fighter on the ground.

The first basic data on bomb distribution and effect was obtained after German fire raids on the cities of Britain. To implement the basic data and provide trials of fire-fighting techniques, tests were conducted on specially constructed buildings, utilizing many types of incendiary bombs and fillings in both the development and finished stage. Analyses of bombing surveys of raids on Germany were studied and evaluated to determine the effectiveness of Allied raids. From these studies came the information utilized in planning operations for the later incendiary raids of the war.

Fire Raising and Targets

In fire raising, there are two factors which must be taken into account to insure successful incendiary attacks on an urban area, an installation, or an industrial target. The first is the inflammability of the target, and the second is the necessity to start individual fires which, in the shortest period of time, will get beyond the capabilities of the fire-fighting personnel to extinguish. When the fire fighters are overextended, there will not be sufficient personnel or equipment to extinguish all the individual fires, which may then spread and merge into larger fires. When these two factors are combined, and wind conditions are right, a

conflagration will ensue, and the best return for the effort expended is obtained.

There are two main types of targets which can be usefully and successfully attacked with incendiary bombs: First, the industrial type targets, viz, factory buildings, and second, the residential or commercial areas which include homes, stores, and offices ordinarily referred to as urban targets, and in which are often located minor industrial buildings.

In planning the attack against industrial targets in particular, there are two characteristics of the target area which must be considered. First, and foremost, is the vulnerability of the area to fire. If the structures and their contents contain more than one-third combustible material, they are suitable targets for incendiary attack. The second characteristic is the exposure of the target to inflammable surroundings, or its contact with adjacent areas which may develop conflagrations, so that if the target itself is missed, fires started in such adjacent areas may merge into a conflagration and still destory it. After a careful and detailed analysis is made, if a target meets these two requirements, an incendiary attack is justified. Assuming for a moment that an industrial area is vulnerable, a successful incendiary attack requires that the proper type of incendiary bomb be selected, and that a sufficient number of bombs be released on the target area to insure that a large enough number of individual fires are started, that cannot be successfully extinguished by the fire-fighting personnel.

In the second type of target containing urban or commercial construction, there are other characteristics which should be considered. Apart from the degree of combustibility of the structure and its contents, the roof coverage of the total area to be attacked is a most important consideration. If the roof coverage of the urban area is less than thirty per cent of the total area, too many bombs, by natural dispersion, would drop in streets, yards and parks so that an effective raid would not result. Together with roof coverage in the target analysis, information on compartmentation of buildings, i.e., the size of the rooms and average distances of fire divisions between them, should be included. In this connection, brick or masonry firewalls and firebreaks must be considered. Firebreaks are normally such features as streets, alleys, rivers and canals. The efficiency of firebreaks, nevertheless, is dependent upon their width, direction, and surface wind conditions at the time of the attack. These characteristics must be kept in mind for the selection of the most effective type of incendiary bomb to use against specific targets.

Zoning of Cities

In order to simplify planning, Air Objective Folders are prepared which outline the target areas in zones. Zone I includes all closely built-up areas, consisting mainly of the central commercial and mixed residential/industrial districts, which are most vulnerable to incendiary attack. In Japanese cities, the population density of Zone I is usually high, being about 80,000 per square mile. Zone II is a little less congested than Zone I and includes those remaining areas of combustible construction, but nevertheless profitable for incendiary attack. The attack is planned to obtain the required bomb density (tons per square mile) on the target areas, dependent upon the zone.

Types of Incendiary Bombs

Incendiary bombs have been designed with varying degrees of terminal velocity so as to penetrate different types of roofs. The types of incendiary bombs suitable for strategic operations, their filling, and penetrating ability are shown in Table I.

It was found in early tests that the AN-M50 type bomb, burning at point of rest, would not start fires readily on a

horizontal surface even though burning at a high temperature. The ejection type bomb is designed to eject its incendiary filling after passing through a roof. In such a bomb, the filling may often strike and burn on a vertical surface, so that each source of fire gives mutual support to its neighbor. The 100-pound and 500-pound bombs are most suitably employed against targets of low combustible content and with large fire divisions, such as factories and large warehouses. However, the 500-pound bomb must be used with a high degree of bombing accuracy for efficient utilization owing to the smaller number that can be carried in each aircraft.

The smaller bombs are carried in aimable clusters which can be set to disintegrate at any desired height above target areas, usually between eight and thirteen thousand feet, depending on circumstances. The individual bombs then follow their own ballistic characteristics and scatter about the area.

Bombs in the Attack

It is obviously preferable and more economical to use only incendiary bombs in attacks against highly inflammable areas, and the incorporation of about fifteen to twenty per cent of explosive head incendiary bombs in each cluster serves to deter home fire-fighters from interfering until the fires can "flash-over" and take hold. Fires started by the small four to ten-pound bombs can be put out within three to five minutes after their inception by the normal householder who furnishes his own first line protection. However, if five minutes or more pass without effective fire fighting, the fire may "flash-over." By "flash-over" is meant the condition which exists when the temperature is raised to such a degree that the surface moisture of the contents of a room is evaporated, and the entire room begins to blaze suddenly and simultaneously. In this case, an appliance fire, i.e., one which the householder with his domestic apparatus cannot control, occurs. A successful incendiary attack depends upon creating a sufficient number of appliance fires so that the equipment of all the fire fighters in the area will be over extended in trying to put out the great number of fires created. The appliance fires will then link up and a conflagration ensue.

The use of a small amount of straight

TABLE I

Type	*Weight (Normal)*	*Filling*	*Concrete Penetrating Ability*	*Action*	*Method of Carriage*	*Type of Roof*
AN-M50 (x)*	4 lb	Magnesium	4"	Local	Aimable Cluster	Medium to Heavy
AN-M69 (x)*	6 lb	Napalm Gasoline	2"	Ejection	Aimable Cluster	Light
AN-M74	10 lb	PT **	4"	Ejection	Aimable Cluster	Heavy
AN-M47	100 lb	Napalm Gasoline	5"	Bursting	Multiple Suspension	Heavy
AN-M76	500 lb	PT **	15"	Bursting	Single	Heavy

* (x) denotes bomb may be furnished with an antipersonnel head.
** PT is powdered magnesium in thickened oil.

high explosive bombs in incendiary raids may be desirable. This was found necessary in some instances in order to break windows to provide ventilation and chimney effect, but it must not be overdone, because too much ventilation causes excessive cooling and prevents the production of flash-over conditions. Tests have been conducted where an incendiary bomb was set off in a room with the windows boarded up. Even after twenty minutes the fire had not taken hold, but when some boarding was removed from the windows and air allowed to reach the fire so that a chimney effect or ventilation was obtained, the fire took hold and a flash-over occurred.

The small percentage of high explosive bombs necessary to break windows should ordinarily be either large blast or fragmentation bombs. High explosives also serve to drive the firefighters to shelter and to break underground watermains causing loss of pressure. However, if too large a percentage of high explosive bombs is dropped during an incendiary attack, buildings will be knocked down, creating debris or rubble which will not burn, so that the firebreaks produced may prevent a conflagration. Such debris may, however, delay or prevent large fire fighting appliances from reaching the fires.

Planning a Raid

In the planning of an incendiary attack, the Air Objective Folders are studied, the individual targets analyzed, and the appropriate munitions are then selected, consideration being given to roof types and compartmentation of buildings. There remains to take into account the aircraft available and the aiming points necessary to employ the force efficiently.

The number of aiming points to be employed depends on the number of aircraft dropping bombs, the bomb load per aircraft, the area of an aiming circle and the bomb density required. The relation is set up in the following formula:

$$\text{Number Aiming Points} = \frac{\text{Number Aircraft Dispatched} \times \text{Bombload per aircraft (tons)} \times \text{Factor}^{*}}{\text{Target Area}^{**}\ \text{(square miles)} \times \text{Density}^{***}}$$

* Factor—Airplanes dispatched dropping on aiming point (100% minus abortives %).

** Area of a circle around each aiming point.

*** Density—Tons per square mile—Experience factor for theater.

The total area that can be attacked is the product of the number of aiming points and the area of the aiming circle.

The number of aircraft to be dispatched, their individual bomb loads, and the theater experience of the percentage of abortive sorties are factors readily available. Analyses of effective operations have shown that a bomb density as high as 200 short tons of incendiary bombs per square mile is required in Zone I and 250 in Zone II to insure destruction of a target area. In the above formula, the target area is the area around one aiming point, with a radius dependent on bombing accuracy. As the mean point of impact in bombing is considered within the radius of a circle whose center is the aiming point, this radius will decrease with an increase in bombing accuracy. Uniform distribution of bombs within the circle surrounding the aiming point is assured by utilizing the proper intervalometer setting for the type of bombs and clusters employed. The distribution produced by the proper intervalometer setting theoretically determines the bomb pattern so that the density of bombs over the entire area approaches the average bomb density which has been planned. A 4,000-foot radius circle was used in the later daylight incendiary raids against Japan, based on the premise that an entire city is larger than

the area a force can efficiently bomb and still maintain the minimum density. If the area to be attacked is small, however, the equation can be transposed so that the number of aircraft that is required to attack an area with the necessary bomb density can be determined.

As an example, the formula may be applied in the following specific case. With the following information available: 270 aircraft (30 per group—9 groups), 4,000 ft. radius circle (1.8 square miles), 10-ton bombload per aircraft, 85% of aircraft bombing on target, 250 tons per square mile (density)—Zone II, and substituted in the formula (page *56*):—we have:—

$$\text{Number of Aiming Points Required} = \frac{270 \times 10 \times 0.85}{1.8 \times 250} = 5.1.$$

With five aiming points necessary to employ the force efficiently and distribute the bombload, two groups would be designated for the attack of each of four aiming points and one group to the fifth aiming point. The fifth aiming point would also be designated as an alternative target for stragglers or groups arriving late over the target area. A total area of nine square miles could be attacked under the conditions stated.

In planning the attack, tactical formations must be considered and the entire attacking force must be utilized to cover all the aiming points. The point of aim selected should be a landmark, river bend, bridge or a factory structure easily recognized from the air. Ground wind velocity and direction must be taken into account in scheduling the order of attacks on the aiming points so that smoke from raging fires of the earlier attacks, does not interfere with visual bombing by later formations. In case aiming points are obscured, provision should be made for use of offset aiming points and radar bombing, as the attacks are planned to be completed on each aiming point before the attack on a subsequent aiming point is begun. Also, the attacks on each aiming point by formations should be completed in the shortest possible time, because it is of the utmost importance that the raid should be concentrated in the minimum period so as to overcome the capabilities of the fire-fighting apparatus and create the conditions for a conflagration. Groups from different wings may be employed to drop sufficient bomb tonnage on each target area.

Effect of Smoke on the Attackers

A further item to consider in selecting aiming points and their order of attack is the distance between them. Aiming points should not be closer than 6,000 feet, because with a ground wind speed of five miles per hour, smoke from fires will travel approximately this distance in fifteen minutes. Considering that propagation of smoke requires about ten minutes after inception of fires, there is only about twenty-five minutes in which to complete an attack and start a subsequent attack on another aiming point, if they are 6,000 feet apart. Higher ground wind velocity will, of course, decrease the time available. Whenever tactical considerations permit, the axis of attack should be determined by the predicted surface wind direction at the target.

Execution of the Attack

Fires set by earlier formations are not coextensive with the smoke produced, and overbombing does not ordinarily result from dropping bombs into a smoke covered area. Even if the target area is obscured by smoke, the attack should be carried out as planned to achieve the required density of bombs, for even though earlier formations may have bombed incorrectly, it is not practical to consider corrections during the attack. The plan of the incendiary attack should follow a time schedule as shown on Chart I.

It should be noted that the aiming

points have been numbered in the order in which they are to be attacked, and that the attack is concentrated within a minimum time over each aiming point. A short time interval between the attack on each aiming point is now allowed to compensate for late arrival of aircraft over the target area. Formations are assigned to each aiming point in sufficient numbers to obtain the required bomb density. In this regard, the leading squadrons assigned to each aiming point may serve as path-finders and employ large incendiary bombs or special target indicating pyrotechnics to mark the area and aiming points.

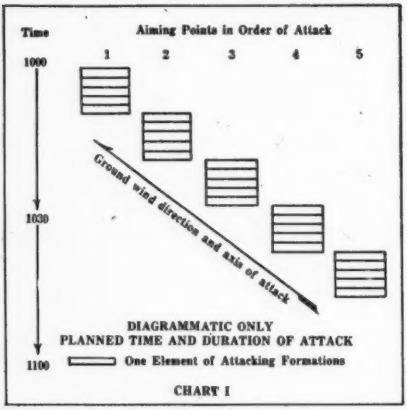

CHART I

In order for the modern mass incendiary air raid to be effective, the planning must take into account many additional factors. This article takes up only the bomb requirement and does not delve into the tactical planning in regard to flak, navigation and strictly air problems. These latter factors must be considered first and foremost, and will govern the actual execution of delivery of the bombs to the target.

We can no longer get away with ducking our international responsibilities. We emerged from World War II the most powerful nation in the world. As such we are responsible in a large measure for safeguarding the peace. To meet this obligation we must remain strong.

Fleet Admiral William F. Halsey, Jr.

Military Labor Service
in the Communications Zone

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APPROXIMATELY twenty-five per cent of the troops found in a normal theater of operations will be assigned to the communications zone. Where lines of communications are unusually long or difficult, the proportion will be even higher. Judging from experience in the recent war even this high percentage does not provide enough service troops: it was customary in most active theaters to find the bulk of the service troops working to the limit of their endurance, with many important tasks left undone for lack of available troops.

Nor was the shortage of personnel limited, by any means, to the communications zone. The entire nation suffered from manpower shortage. Such a situation, which will probably recur if, unfortunately, we have another war, demands that we utilize to the maximum every available manpower source. Two sources worthy of special study are prisoners of war (POWs), and civilians living in the theater of operations. This article will discuss some of the lessons learned in the organization of a Military Labor Service, in the European Theater Communications Zone, as one phase of the exploitation of these sources.

Regulations Governing Use of POWs

Regulations governing the use of prisoners of war are well established, and should be studied carefully before any attempt is made to exploit such labor. The United States is a party to the two conventions signed at Geneva, Switzerland, on 27 July 1929. One of these fixes the obligations of the captor power with respect to the treatment of prisoners of war. War Department regulations governing prisoners prescribe adherence to the spirit, as well as the letter, of these regulations. Most of the essential provisions of the convention are embodied in FM 27-10. Rights, privileges, obligations, and treatment of prisoners of war are covered in rules of land warfare. Detailed discussion of these limitations is outside the province of this paper; however, their importance should not be overlooked.

Once a prisoner has been captured, he is examined, collected with other similar prisoners, and evacuated as rapidly as possible from the combat zone to the communications zone enclosures. There he is quickly processed by trained personnel in prisoner of war processing companies. Basic personnel records are completed in triplicate with photographs, fingerprints, and other information. The original of the basic personnel record accompanies the prisoner thereafter.

Wherever they may be kept, prisoners represent a special problem. They must be fed, clothed, housed, given medical care, protected, and guarded lest they escape. Special records must be kept, and reports must be made. They must be accessible to visits by representatives of the protecting power. Even in efficient central enclosures they represent a considerable drain on

manpower and supply resources—for example, the standard 20,000 man enclosure in the European Theater took more than 1,000 U.S. personnel for guards, administration, and other necessary activities.

Prisoners, other than officers, may be required to perform labor; and except for labor which primarily benefits themselves, their record is credited with pay for work performed. There are many restrictions as to the type of work they may be required to do. It is forbidden to employ them for manufacturing and transporting arms or munitions, or on unhealthful or dangerous work. All of these regulations are discussed in detail in the manuals previously referred to, and must be followed. Unfortunately, the regulations tell what may *not* be done. Nowhere is there any publication written to tell what *may* be done, and how to do it. Yet there are many types of work for which prisoners can and should be used. It has been found easier to stick to U.S. soldier labor (if available), which does not involve unfamiliar problems, in spite of the fact that this country cannot afford such economic waste. When properly trained, equipped, and used, the prisoner becomes an economic asset, rather than a liability.

Methods of Employing POWs

The easiest way to employ prisoners is for a service installation located near a central enclosure to arrange for a group to be sent each day for work, returning each evening to the enclosure. The only problems are those of providing guards, transportation, and supervision. Subject to availability in the enclosure, widely fluctuating numbers may be used; if the prisoners are not needed on a particular day, they are merely left in the enclosure. Prisoners who are awaiting further evacuation, perhaps to the zone of the interior, may be employed in this manner. Where the work to be done is unskilled labor, this method offers a number of advantages.

Several disadvantages to this method will suggest themselves at once. It is difficult to insure continuity under this system—to get the same men day after day, so that they learn their jobs and become efficient workers. Under the conditions existing in a theater of operations, it is particularly difficult to get satisfactory results with this method on tasks requiring a high degree of skill—as, for example, the operation of a bakery. Communications zone installations are widely scattered throughout the country; those installations far from central enclosures cannot get POW labor under this method.

Another serious drawback is that work loads are continually shifting from one part of the communications zone to another, yet it is difficult with this method to shift work groups which have once been trained and equipped. Still another drawback is the heavy administrative burden on the enclosure, keeping track of many special work groups.

The final test of any system for employing prisoner labor is the efficiency with which work is performed. If it be satisfactory, U.S. service troops which would otherwise be required, may be released for employment elsewhere. For any long-term program of this magnitude, some better method is required.

Labor Service Units

A method offering much promise is the organization of POWs into labor service units. Under this method POWs should be screened to select the able-bodies ones, then separated according to their skills. Personnel thus selected should be organized into specialized service units, in a manner very similar to the organization within our own Army. Some form of supervisory organization must be provided, and provision made for the necessary records to be kept without daily return to the central enclosure. Units organized along these lines can be employed in much the same manner as U.S. service troops, subject to the problems of guarding them

and complying with the many POW regulations. They can be trained to a high degree of efficiency. They can be moved from place to place as the work load varies. When properly organized, they can replace like U.S. units.

Several steps should be followed in developing a labor service unit program. First of all, there must be a determination of the types of units needed. This must be done in the communications zone or the theater headquarters, and must be tied in closely with the G-3 troop planning. It would be futile, for example, for one base section to concentrate on organizing laundry companies when there was a surplus of laundry companies in the theater as a whole.

Special effort should be made to organize POW hospitals, using all available protected (medical) personnel, to avoid overloading our own hospitals.

As part of this step, orderly provision must be made for the necessary supervisory personnel. Here the best solution found so far is the organization of Labor Supervision Units (T/O&E 20-20T). These provide headquarters for the supervision of companies and separate platoons, plus district (battalion size) and area (group size) headquarters for command organization. The platoon and company headquarters are provided by the T/E with enough housekeeping equipment for the prisoners, as well as the headquarters personnel. These supervisory units must be approved by the War Department as an addition to the theater troop basis;

Prisoners of war at work in the American zone. (Signal Corps photo.)

they will prove a profitable investment of manpower.

Another essential step is the provision of the necessary equipment for the POW units. With many service troop units, the personnel is really a means to get machinery to operate. Without machinery, the new units will have little value. Here a theater project should be drawn up, and presented for War Department approval so the equipment may be available. Maximum use should, of course, be made of captured equipment, and of equipment purchased locally.

Another important step is to determine in advance the command relationship of the new units. Are they to be commanded by the provost marshal, as was tried in some places? Are they to be under the command of the service chiefs in the base or advanced section headquarters, as are our own service units, or are they to become a separate command, reporting through their own channels direct to the section commander and under the technical services for operational control only? Who is to furnish the guards?

Here the best solution is to assign the POW units to the using services, just as army service units are assigned. Some central organization will probably be necessary within each section headquarters, to handle the large volume of special administrative papers and reports, but it should have no more command authority than the adjutant general has over U.S. units.

The question of guards for these units deserves special study. The easiest solution, from the point of view of the staff officer safetly situated in headquarters, is to require the using service to provide the guards. However, this means that skilled technical personnel, badly needed for productive work, must be used. When POW units are used in a large depot, already provided with perimeter guard, and can be bivouacked inside the depot, little additional guard should be necessary. No single solution to the guard problem can be given; each case must be analyzed as a separate problem.

Occasionally, the particular type of prisoner available will prove troublesome and require large numbers of guards, but in most cases, careful study will permit their employment with reasonable numbers. From a purely economic point of view, it is better to let a few hundred prisoners escape than to tie up many extra thousands of U.S. soldiers as guards.

Last, but by no means least, the whole idea of using POW service units must be sold to the entire command. Otherwise force of habit will prevent full utilization of this manpower source.

Properly organized, such a program offers many advantages. It makes the best possible use of the skilled labor potentially available. It provides troop units possessing many of the characteristics of normal U.S. troop units. It releases manpower for combat and for other critical service tasks.

Civilian Labor

Much the same procedure may be followed to organize civilians into mobile labor units. Frequently in a theater of operations one area will have a surplus of available civilian workers, while another area having many army installations will have a serious shortage. Civilians cannot be ordered to move unorganized to a distant area and start work; some provision must be made to insure that they get food, quarters, and other care. Civilians can be organized into mobile labor units, given semi-military status, and moved from place to place as work loads vary. One example of the types of problems which could be solved by this method is the providing of telephone operators, stock record clerks, and similar personnel for an advanced section headquarters. For many of these jobs, properly screened and trained civilians can serve

at least as well as soldiers. Yet, characteristically, an advanced section headquarters moves so often that it is impractical to train new civilian employees at each place. By training civilians and organizing them as a mobile civilian labor company, numbers of highly skilled soldiers could be released for employment in the combat zone. Where large numbers of displaced persons are present, this procedure offers many advantages.

History in World War II

North Africa: The number of POWs captured in the Pacific was so small that relatively little was done to organize them for labor. In the North African and European Theaters, however, extensive use was made of POW labor, and many lessons were learned. These lessons should be studied and the doctrine revised accordingly, so that future operations may avoid unnecessary waste motion.

For the first time in our recent military history, large numbers of the enemy were captured by our Army during the axis collapse in Tunisia. A few units were captured intact, complete with their organizational equipment—notably one excellent German bakery unit, which was promptly put to work baking bread, and a first class band, complete with instruments. At the same time, the theater faced a critical shortage of service troops, with huge stocks of supplies still in North Africa, and with two amphibious operations (Sicily and Italy) in the offing. The nature of these amphibious operations was such that bases in North Africa would continue to be required for more than a year. Under the circumstances there just were not enough service troops.

To meet this shortage, more than 60,000 Italian POWs were organized into service units, using T/Os very similar to those corresponding to our own service units. After the collapse of Italy, when Italians were granted co-belligerant status, this program was expanded to include truck companies and many other types not normally practical for POW personnel. Many Italian officers volunteered for service with these units. Special T/O&Es, based on Army tables but stripped of all luxury items, were approved by the War Department, and the units organized according to these tables were added to the theater Troop List for Operations and Supply.

Orderly provision for supervisory personnel was not made at the time this was done, however, and the using services had to provide such personnel by robbing their own units. Most of the Italian units were kept in rather large enclosures, each containing several thousand men and served by central messes and other administrative installations.

During the winter of 1943-1944 several thousands of these Italian cooperators were sent to England, where they rendered good service.

By early summer, 1944, it became evident that many of these units would have to be taken into Southern France, because, while the force participating in that operation contained many French combat troops, there were but few French service troops. Thus, communications zone support would have had to be furnished largely by U.S. troops. The French were able to get excellent combat soldiers in North Africa, but skilled service technicians just simply were not there in adequate numbers. Consequently, steps were taken to separate individual units and prepare them for independent operation. Three "Technical Supervisory Regiments" were organized—one each for North Africa, for Southern France, and for Italy (where many units of the Italian Army were serving in the communications zone under U. S. supervision).

More than 30,000 Italians serving in these Italian Service Units (as they were called) were taken to France. All were repatriated during late summer, 1945. The balance of the original units was

taken to Italy in late 1944 and early 1945.

The help these Italian soldiers gave to the logistical operations of our forces has not received full credit. Without their help, many additional thousands of U. S. soldiers would have had to have been employed, and the critical manpower shortage would have been that much worse.

European Theater: Prior to the landing in France, the European Theater had little experience in the employment of POW labor. After the Normandy invasion, huge numbers of POWs were captured and immediately put to work. First efforts to organize them for technical labor was undertaken in Southern France and were patterned after the action taken earlier in North Africa.

By January 1945, a Military Labor Service had been organized as a separate staff section in Communications Zone Headquarters, with counterparts in most base and advanced section headquarters. To meet the need for supervisory personnel, T/O&E 20-20T was drawn up and flown to Washington; within a very few weeks War Department approval was received and organization of the units began in earnest.

Initially the Military Labor Service was developed within many section headquarters as a separate command channel, exercising command supervision over the labor units. Technical services using them exercised operational control, but had no command control. Ultimately this principle was abandoned in a number of sections. For many reasons it appears undesirable. For example, it was found under this arrangement to be very difficult to obtain qualified personnel for the newly formed supervisory units. It was particulary difficult to obtain qualified technical specialists to furnish supervision on the job. Consequently, many supervisory units tended to concentrate on the *administration* of the POWs, leaving all *technical supervision* to the using services.

By early spring, 1945, the Military Labor Service was abolished as a separate staff section in Communications Zone Headquarters, and all personnel and functions transferred to G-3.

With vigorous command impetus throughout, the organization and use of POW labor units progressed rapidly, until by late summer 1945 they contained more than 475,000 personnel. In addition, a number of Mobile Civilian Labor Companies, mostly using displaced persons, were proving valuable aids. Several large depots were operated entirely by POW units, with just a handful of Americans to maintain general supervision. Much initiative and ingenuity were exercised by local commanders to utilize the skilled labor made available.

Conclusion: Both from the lessons of actual experience and from theory, it appears that any large-scale and continuing program to utilize POW labor in the Communications Zone should include provision for the organization of POWs into regular service troop units. This should be done in an orderly manner, geared to fit the theater troop list and to provide those units most needed (subject, of course, to the limitations placed on employment of POWs). Provision must be made for supervisory personnel, and for unit equipment. Command channels and questions of procedure must be clearly defined. In some cases the program should include similar organizations for mobile civilian labor.

With manpower shortages in time of war an established fact, it is imperative that we make the best possible use of *all* available resources.

MILITARY NOTES AROUND THE WORLD

PHILIPPINES

Agreement on Bases

A 99-year agreement on five major American military bases and ten minor posts in the Philippines has been formally signed by the Philippine and United States Governments. In the interest of inter-nation security, any of the bases may be made available to the security council of the United Nations.

The United States proposes to retain in the Philippines only such forces as required to man the bases and to constitute a small military mission. Troops now in the Philippines not required for these purposes will be shifted.

The United States Army will maintain its principal military establishment at Ft. Stotsenberg, Pampanga Province, Central Luzon. The United States Navy will maintain four operating areas: Leyte-Samar, centered at Guiuan; Subic Bay, Luzon; Tawitawi, near the southern end of the Archipelago; and Sangley Point, Cavite. Ten other areas of limited size were also designated as bases.

American use of many military landmarks such as Ft. McKinley, Nichols Field, and the Manila area, is ended by the agreement. The Philippine government retains jurisdiction over all offenses committed outside bases by members of the U.S. Armed Forces, except offenses committed in performance of specific military duty, or when both parties are members of the U.S. Armed Forces. (News reports)

LIBYA

International Base

An international military, naval and air base in Libya, northern Africa, in which the United States would share, is reported under consideration in London. The proposal is that a part of Cyrenaica between Benghazi and Tobruk, or part of Tripolitania, be declared an international strategic area.

Such an area would give the United States a base in the eastern Mediterranean in connection with commitments in Greece and Turkey, and its Middle Eastern oil interests. It would give Britain a base to which to withdraw forces from Egypt and Palestine.

The proposal is only one of various possibilities in the rapidly changing strategic position of Britain in this area. One group in the British Army is said to favor concentration on North Africa as a new strategic area and withdrawal from Greece and the Middle East. (*The New York Times*)

GREAT BRITAIN

New Staff College

The admiralty, War Office and Air Ministry have announced a new Staff College at Latimer House, Chesham, Bucks, to be known as the Joint Services Staff College. The college is to train officers already qualified in staff work of their own services for appointments on joint staffs and for higher staff appointments in their own services; to develop mutual understanding and common doctrine between the services, and to standardize staff work.

Each course will last six months for 100 students. Students will come from the Navy, Army, and Air Force, Home Civil Service, the Dominions and India. Officers will attend the college after passing through their respective staff colleges and before attending the Imperial Defense College.

Subjects to be studied are the organization and capabilities of the three services, Imperial strategy, inter-service and joint operations, and joint operations. Weapon and equipment development, scientific warfare, military geography, war production and modern production methods, and the governmental and central direction of war will be included. Each service will provide the commandant of the College in turn. (*The Fighting Forces*)

PANAMA

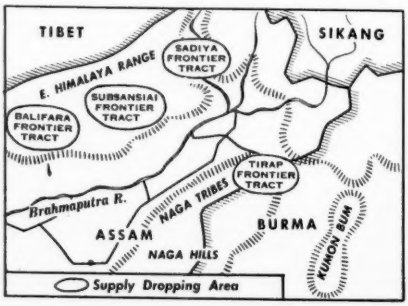
Canal Plans

Samples of soil and rock from the Isthmus of Panama will be brought to Harvard University to be tested for new canal facilities. There are plans for a third set of locks to the present canal, conversion of the present lock canal into a sea-level canal, and a new sea-level canal in another part of the Isthmus. Congress will be presented the plans for approval before the end of 1947. (*The New York Times*)

INDIA

Supply by Air

More than 300 tons of civil and military supplies were dropped recently by parachute to eleven units of the Assam Rifles in the Sadiya, Belifara and Tirap frontier tracts, along the Assam-Tibet and Assam-China borders.



Nearly 200 sorties are necessary before each of the frontier posts receives its six months' quota of supplies. The posts are situated in some of the most inaccessible country in the world. The advent of air supply has eliminated the use of nearly 3,000 coolies, each of whom used to carry a 60-pound pack and make the hazardous trek in several months. (*Indian Information*)

Armored Training

First group of Madrassis to volunteer for the 16th Light Cavalry have now taken to armor, learning to man tanks and guns, at the Indian Armored Corps Trade Training Center, Babina.

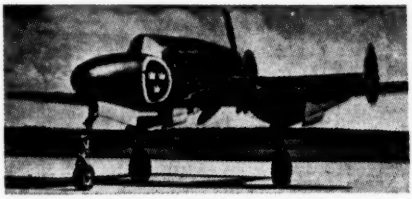
The 16th Light Cavalry was one of the first IAC regiments to be selected for nationalization and the first to see battle under an Indian commander. It took part in the Meiktila operations and was with the 14th Army's spearheads which linked up with 15th Indian Corps outside Rangoon. (*Indian Information*)

SWEDEN

Swedish Air Force

The Royal Swedish Air Force (Flygvapnet) is changing equipment with accent on fighter aircraft. At present there are seven fighter Wings and six bomber Wings, while new orders call for ten fighter Wings and four bomber Wings. Reconnaissance Wings are to be cut from three to two.

The Swedish Air Force before World War II was largely dependent for equipment on outside sources. Sweden's isolation forced it to reorganize, and the Svenska Aeroplan A.B. (Saab) at Linköping is now a large concern with impressive production in underground factories.



Saab 21A.

The Swedish Air Force has many aircraft types, but these are being reduced. Fighter aircraft are to be jet-propelled, but until her own jets are built, a number of British and American aircraft have been ordered. In April 1945, fifty North American P-51D Mustangs were bought, and designated J 26. Ninety of these aircraft have now been bought from U.S. Army surplus.

The first jet in the Swedish Air Force is the de Havilland Vampire of *Flygflottilj* (Wing) 13 at Norrköping. So far about twenty-five Vampires, or J 28s, have been delivered out of seventy. One hundred North American Harvard advanced trainers are on order.

During the war, Saab concentrated on the Saab 17 and 18. The current 18 production type is the B 18B with Swedish-built Daimler-Benz DB 605B motors of 1,475 horsepower. A reconnaissance version is the S 18A. The T 18B torpedo version, armed with two 20-mm cannon, will shortly replace the B 3 (Junkers Ju 86).

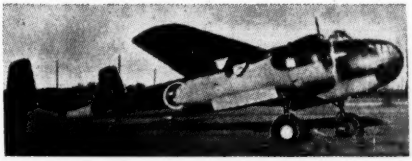
The Swedish Air Force designed and produced its own single-seat fighter, the J 22. Several hundred were built.

The fighter Wings equipped with Swed-

J 22.

ish-built aircraft use either the J 22 or the newer Saab J 21 twin-boom pusher monoplane. The latter is being developed into a jet-propelled type of which 120 will equip two Wings.

Following the J 21 R will come the J 29 single jet fighter in mid-1948, and later the Saab 1001 single-motor monoplane



Saab 18A.

with swept-back wing, rated at 650-680 miles per hour. (*The Aeroplane Spotter*, London)

NORWAY

Spitsbergen Decision

The Norwegian *Storting* (Parliament) has decided against entering into bilateral discussions with the Soviet Union on military questions concerning Spitsbergen. The vote was 101 to 11.

The Storting based its stand on the fact that the situation is now different from what it was during the war, when the Russians badly needed a stronghold on Spitsbergen to defend Murmansk convoys. (*The New York Times*)

CANADA

Unification of Services

Unification of the three armed services of Canada is well underway following their integration under a single Minister of National Defense late in 1946.

Declaring that the purpose of the new plan was to keep the "defense establishment sufficiently flexible so it would fit into any plan of defense or any form of disarmament," the new defense minister made plans to cut $50,000,000 off the $440,000,000 budget for the current year for the Army, Navy and Air Force, and has announced a twenty-five per cent reduction in the strength of the peacetime forces.

During the war, the three departments were completely divorced, but coordinated under a chiefs of staff committee. Under the new set up, the chiefs of staff will continue, but there will be only one deputy minister under the Minister of Defense, instead of three deputy ministers, each representing a service, as planned at first. Eventually there will be a single staff and one staff college for all three services.

Canada will keep in operation the airfields along the Alaska Highway, and continue to expand the system of weather stations in the Arctic in cooperation with the United States. (News reports)

AUSTRALIA

Antarctic Flight

The first of a series of flights by Royal Australian Air Force planes over Antarctic waters has been completed by a Liberator bomber. The aircraft covered more than 2,000 miles and returned to its base at Pearce, Western Australia, thirteen hours after taking off. The main purpose of the flight and of others being planned is to make weather observations. The Liberator crew reported continuous clouds and a 60-mile-an-hour wind over southern seas. Another Liberator was scheduled for a survey flight to Macquarie Island, 1,000 miles southeast of Tasmania, to gather information for an Australian Antarctic expedition which will set out later this year. (*Australian News Summary*)

GERMANY

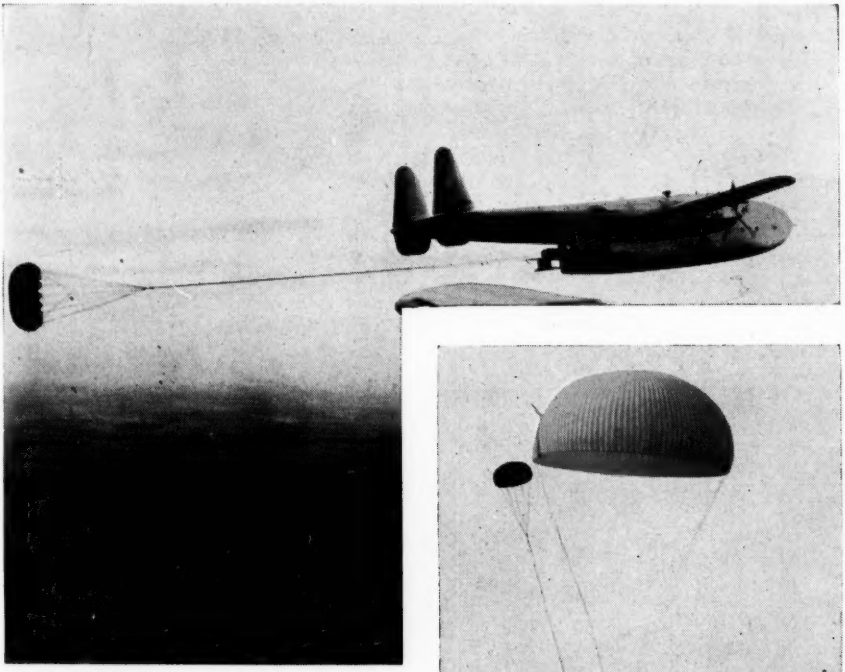
Concrete Ships

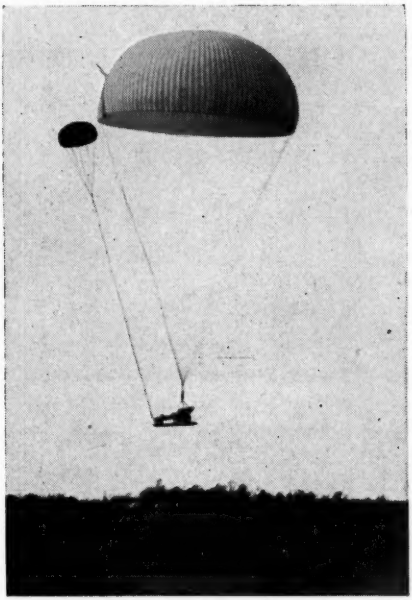
Fifty 300-ton concrete motor freighters were built by the Germans to save steel. All of the vessels were put into service in the North Sea, the Baltic and along the Norwegian coast and all stood up well. Under test, one ship's hull withstood an explosion of 100 kilograms of dynamite on its side at a depth of ten meters. The limit of resistance was reached with a test explosion amidships at thirty meters underneath the vessel. (*The New York Times*)

Plane Spotting

German spotters could locate planes twelve miles away with uncanny accuracy toward the close of World War II by means of reaction of infra-red rays to the heat of engine exhaust. American engineers report that Germany was further advanced than any other nation in the knowledge and use of the invisible ray. (*Flying*)

UNITED STATES





Cargo Para-Drop

Ribbon parachutes, already successfully utilized to retrieve instruments from V-2 rockets, have proved just as effective in lowering a 2,240 pound 75-mm howitzer from a C-82.

The new method of dropping heavy equipment was devised by the Air Matériel Command in cooperation with Army Ground Forces to make heavy field equipment as mobile as possible for supply by air.

To get the howitzer out of the plane, two parachutes are used. A 14-foot parachute pulls the cargo through the rear doors. When the load clears the fuselage, a 90-foot parachute opens to lower the equipment to the ground. The cargo is packed on a wooden skid, and can be loaded into the plane on a conveyor in fifteen minutes. (AAF photos)

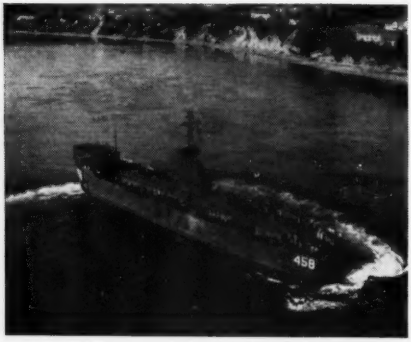
The Cycloidal Propeller

Tests being made by the Army Transportation Corps and the Navy with the Cycloidal propeller may result in an important marine development.

Cycloidal propulsion has been developing for more than forty years. Patents are held by American and German engineers.

The cycloidal propeller consists of a horizontal disc in the bottom of the ship. The disc is revolved by propulsion engines. Mounted on the disc vertically near its rim are four or more verticle blades which move in a horizontal circle when the disc is revolved.

American experiments have proceeded



with a fixed-pitch propeller, requiring a clutch and engine speed control to alter speed. The Germans developed a variable-pitch propeller which controls the vessel speed without altering engine speed or unclutching the propeller drive.

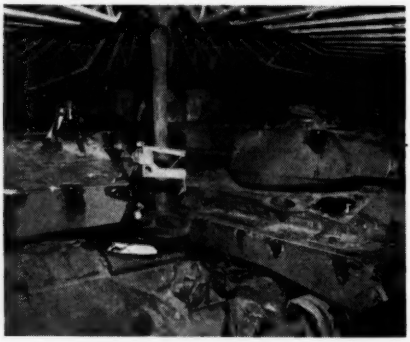
To speed results, the Navy undertook development of the fixed-pitch propeller, and the Transportation Corps the work on the variable-pitch.

The forty-six foot tug used by the Transportation Corps in its tests with the variable-pitch propeller shows that the boat may be revolved without forward movement, and may even be moved crabwise. (*U.S. Coast Guard Magazine*)

Canned Ordnance

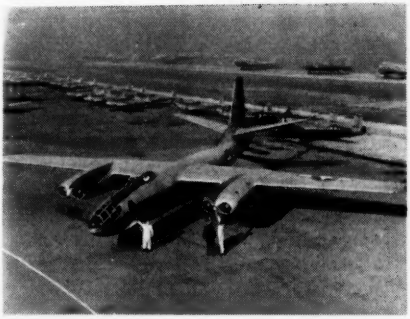
Army Ordnance has developed a process of "canning" armored equipment at the Lima Ordnance Depot in Ohio.

The process is said to assure effective storage for fifty years. By this method, all types of ordnance can be inclosed in steel or aluminum containers.



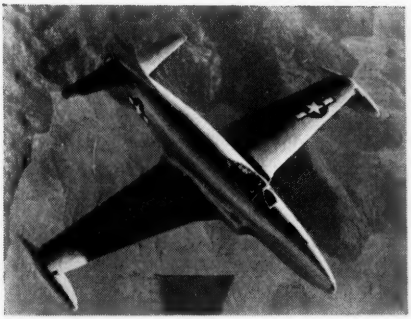
In these views, a group of the storage containers have been completed and are ready for dehumidification. The second picture shows an interior just before workmen closed the hatches and sealed the armored vehicles inside. (*Signal Corps photos*)

Aircraft Developments



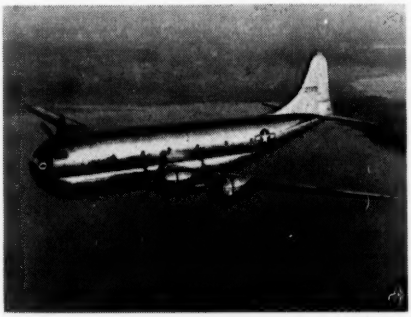
North American XB-45.

Undergoing preliminary tests is the new AAF four-jet bomber, the North American XB-45. A heavy bomber by World War II standards, the XB-45 is classed as a medium bomber in the jet-fleet now being constructed for the AAF. Wing-span is 89½ feet, length 74 feet.



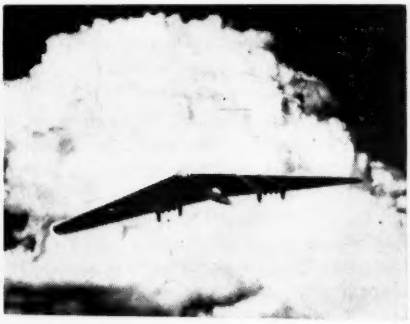
Lockheed P-80A.

An order for 134 improved Lockheed P-80 Shooting Star jet fighters, to be known as the P-80A, has been placed by the AAF. The new version features greater fire-power and fireproofing, and employs water injection in its J-33 jet engine to increase take-off and climb performance.



Boeing YC-97.

Ten YC-97 Stratofreighters are being built by Boeing Aircraft. Six planes will use Wright Cyclone 2,200 hp engines, while three, called YC-97A, will use Pratt-Whitney 3,500 hp engines. The tenth, a YC-97B, will be a personnel transport.



Northrop YB-49 (Model).

A jet version of the B-35 "Flying Wing" is the Northrop YB-49. The YB-49 has eight jet engines, producing a thrust of 32,000 pounds. Wing-span is 172 feet, length 53 feet. Vertical air separators increase directional stability. (*AAF photos*)

Miscellaneous Notes

Guided Missile

An invention which may revolutionize remote-control combat weapons is the "Kingfisher," which is nearing completion by the National Bureau of Standards. A development from the "Bat," the "Kingfisher" makes that missile obsolete in many respects because it is more accurate, more powerful and does not require a homing plane for operation. (News reports)

Rocket Developments

Continued rocket experiments at White Sands, New Mexico, are enlarging man's knowledge of space nearly 100 miles above the earth. Instruments from the rockets have been successfully recovered by means of parachutes, including cameras with pictures showing distances up to 900 miles. Living insects placed inside the rockets have survived the supersonic speeds with no apparent ill effects. The seventy-five per cent successful launching of the German-captured V-2 rockets in the American tests compared with eighty per cent achieved by the Germans, a difference which is attributed to progressive deterioration since 1945. (*Science News Letter* and news reports)

Interchangeable Cylinders

Three types of gasoline engines with a wide range of horsepower may be made from interchangeable cylinders which have been developed by Army Ordnance. Many different engines may be made by assembling a given number of cylinders and supplying the proper crankshafts. Horsepower ranges are from 15 to 1,400, and cylinder groupings can be "in line," "V," or horizontally opposed, permitting various applications. (*Army Times*)

Weather Stations

At nine points in the Arctic, weather stations will be established by Canada and the United States in the next three years. The Eureka Sound and Melville Island stations will be in operation this summer. (*The New York Times*)

"Flour" Explosive

An explosive, made to look like flour and capable of being eaten when baked into bread, was developed secretly during World War II by Professor George B. Kistiakowsky, of Harvard. Shipped to neutral countries in bags labeled "flour," the product was transshipped to Japanese depots, where much of it fell into the hands of saboteurs and guerrillas operating behind Japanese lines in China. The Japanese failed to discover the secret. (*The New York Times*)

"Williwaw" Lessons

As Task Force Williwaw completed its tests in the Aleutians, it was reported that U.S. soldiers, as now equipped, can survive and fight only for short periods in the wet-cold of that northern climate. The need for light portable shelter, a tundra and mountain-crossing vehicle similar to the weasel, clothing that will better protect the face, self-heating emergency ration cans, tanks with better optical equipment, and a waterproof rifle stock, was noted. (News reports)

Antarctic Results

Naval operations in the Antarctic early this year resulted in four main accomplishments: The most extensive and intensive exploration of Antarctica yet made; proof that transport planes can leave carriers and land on skis, and that air-strips for large aircraft can be built on glacial ice; furnished 4,000 men with experience in cold weather and ice operations and tested many types of equipment; and scientific observations. (News reports)

Sea Rescue

A flying-suit designed to help save the lives of pilots downed at sea has been developed by Air Matériel Command engineers. The suit has built-in inflation bladders which make it impossible for the wearer to lie on his face in the water. (*Army and Navy Bulletin*)

FOREIGN MILITARY DIGESTS

Airborne Operations

Translated and digested by the MILITARY REVIEW from an article by Colonel Ricardo Munaig, in "Ejército" (Spain) November 1946.

IN maneuvers at Kiev in 1935, the Red Army undertook a surprise airborne operation with 1,500 parachute troops. Russian propaganda then laid great stress on the increasing number of parachute troops being trained, and other nations started worrying about the matter. In Russia, however, it seems that the employment of large parachute or airborne infantry formations has been given up. It is not known if this is due to tactical considerations, to lack of adequate airplanes, or to exaggerations of Red propaganda at the time.

In World War II, the Red Air Force landed paratroops in very few instances: on a Danish island, in the German rear areas as small groups of saboteurs or to organize guerrilla bands, and in their own rear areas, to attack advance elements of German armor that had breached the Soviet lines in places where there were no ground troops to stop them. In all cases, the Russian paratroopers were wiped out.

In Germany, Marshal Goering realized the importance of airborne troops, and in the air regiment "General Goering" a paratroop battalion of volunteers was organized. The 1st Parachute Division became the core of this new arm, and it appeared in public for the first time, on 20 April 1933, in a great military parade in Berlin.

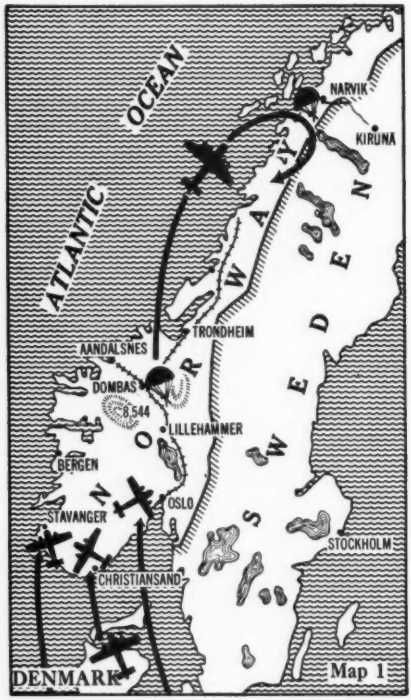
The British studied the possibilities of employing paratroopers and airborne troops for several years, but they considered using them only during the later phases of World War II—in reconquering Burma; and in the invasion of Europe.

German Operations

Norway—The campaign in Norway, launched with great violence, was the first revelation of the existence of airborne troops during World War II. Due to the necessity of getting there before the British—who arrived ten hours later—the *Oberkommando der Wehrmacht* (High Command of the Armed Forces), which did not have control of the sea, had to use every resource available. One of these was the *Fliegerkorps*, a recently organized air unit.

In the first few days, they transported engineer, signal, quartermaster, medical and infantry companies, alpine troops, field artillery batteries, automobiles, light tanks, antiaircraft artillery, clothes, food, tents, radio stations, meteorological equipment, airdrome equipment, guard crews for the air units, civilian and office personnel; in general, everything needed to administer an army which in a few days amounted to 100,000 men. With these units, the Germans undertook the occupation of Norway, a country of great distances and having perhaps the worst topography and climatic conditions in the world.

In addition, the Norwegian Army and the Franco-British Expeditionary Forces had to be defeated. The latter had disembarked at Aandalsnes, Namsos, Harstadt and Narvik, creating a series of infiltrations in the central part, generally along a road or railroad constituting the only



possible means of communication between the German garrisons, especially the one at Narvik, 2,000 kilometers from the home bases. The use of airborne troops at Dombas and Narvik secured these places, and the advance of the *Wehrmacht* forced the British to withdraw after capturing Narvik. The Norwegian Army surrendered on 10 June, two days after the British departure.

The Low Countries—The campaign in the west was preceded by intensive air bombardment of all known airdromes of France and the Low Countries, where many grounded airplanes were destroyed. Almost simultaneously, and with great surprise, the invasion of Holland was launched. In this campaign the airborne troops fulfilled outstanding missions in the occupation of strategic points, the most important being Rotterdam, 110 kilometers from the German frontier.

Eben Emael—At the same time, the *Wehrmacht* penetrated into Belgium, and in this advance, the airborne troops participated in another spectacular operation —Eben Emael. The Belgians had learned their lesson in 1914, and the new fortifications were far more powerful than they had been then. Fort Eben Emael, one of the most important, covers a large section, it is triangular in shape, with one of its sides based on a relatively deep canal. For an advance from the German frontier, this fortification constituted a seriously neutralizing obstacle.

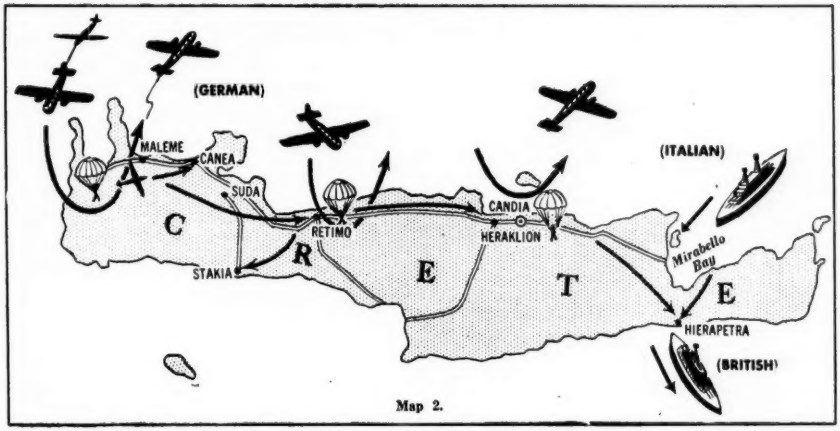
On the morning of 13 May 1940, an air formation let loose a few towed gliders in the rear of Eben Emael, transporting a section of paratroopers. These silent planes landed in the central plain of the fortified triangle without being detected by defending troops whose attention was drawn by another platoon of paratroopers that landed on the outside and planned to cross the canal in rubber boats. In the meantime, the principal group was attacking blockhouses and their approaches, using flame-throwers, hand bombs, packaged TNT, and hand weapons. The garrison of about 1,000 men, completely surprised, surrendered to the Germans.

Corinth—Months after the German victory in the west, the developments in Jugoslavia and the Italian attacks on Albania and Greece took place. As a result, the *Wehrmacht* was involved in the so-called Balkans Campaign, the last of its *blitzkrieg* campaigns. The participation of the

airborne forces was brief, but produced outstanding results; in Crete they achieved the unbelievable.

After Greek resistance had been broken in the passes of the Hellenic mountains, the ground army was advancing, in mid-April 1941, in three separate columns: one column from Larissa, had attacked the island of Eubea, and coming back on the mainland, was trying to enter Athens from the east; another, after crossing the famous pass of Thermopylae, marched through Thebes towards Elensia, and from

The first wave of paratroops landed north of the canal and immediately took up positions; in their descent they received fire from antiaircraft weapons. The antiaircraft and antitank weapons that defended the railroad bridge were used by the paratroopers to protect the crossing of the canal, which was assured, with the establishment of a solid bridgehead, two hours after the first attack. The Corinthian stronghold was captured at 1300 hours, and 950 British and 1,450 Greeks made prisoners of war.



Map 2.

there was attacking Athens from the west; and a third column (the *Waffen SS*) was advancing through the western part from Larissa and Arta toward Lepanto. The British forces were withdrawing rapidly through the Corinthian Isthmus towards the Peloponnesus.

The Corinthian Isthmus is cut by a navigable canal whose depth and steepness constitute an almost insurmountable obstacle for an overland route. The German High Command decided to capture the Corinthian pass to establish a bridgehead that would guarantee the crossing of its ground troops and stop the enemy from undertaking a southward penetration. This mission, of course, was assigned to the air forces.

Crete—Although the Crete operation was undertaken a year after the invasion of Norway and the Low Countries, it was, in our opinion, the real surprise in this type of war, not only because it constituted the invasion of an island, but also because it was surrounded by a sea completely controlled by the enemy.

Since mid-May 1941, German aviation based on the Peloponnesus had been systematically bombarding all military objectives on the island of Crete, especially its airdromes.

The air landing was launched on three main points: Maleme, Retimo and Heraklion, all on the northern slopes of the island. The main landings were made at Maleme, and from there they continued

advancing eastward and, after hard fighting, joined forces with the paratroopers at the other two points. Later they advanced towards the south to occupy Stakia and Hierapetra, and to intercept the withdrawal of the greater part of the island defenders trying to embark for Egypt.

The Germans were calculated to have had 10,000 men. Their losses were, of course, relatively high. Many planes and gliders were lost or damaged on landing. In respect to personnel, the official communique published the following losses: Army, 321 dead, 287 wounded, and 524 missing; the *Luftwaffe*, 1,032 dead, 1,632 wounded, and 2,097 missing. The high number of missing can be attributed to the loss in flight over the sea, especially during the early days, due to British naval action.

It is estimated that there were 40,000 defenders on the island. There were 10,700 British and 5,000 Greek prisoners of war captured. On land, there were 5,000 dead, without counting those lost at sea. Therefore, approximately half of the force saved themselves by sailing.

Paratroops without Parachutes

The Russian Front—The first real participation of paratroops as ground forces was undertaken on the Leningrad front in the winter of 1941-42. The German front extended itself, forming a large semicircle, from Oranienbaum, on the Gulf of Finland, to Schlüsselberg, on Lake Ladoga. The old czarist capital was left isolated from the southern tip of the Karelian Isthmus to the northern sector of the Finnish front.

The situation of the great metropolis, whose war industry was indispensable to the Soviet defenses, was extremely critical. Great effort was required to weaken the German hold and establish routes of communication more favorable than those over Lake Ladoga.

The German front was extended and weak at certain points. The exceptional harshness of the winter made it impossible to send reinforcements by land, and ice more or less blocked the Gulf of Finland. The Russian High Command realized this and believed it possible to force the Neva front.

They prepared the attack conscientiously. Above all, they bombarded the German lines with artillery fire unprecedented in intensity. They then launched their attack with regiments of laborers and sailors from Leningrad. The attack through Schlüsselberg was able to breach the weak German line, forming a wedge that endangered the whole front.

The German high command was unable to mobilize enough ground troops during this emergency, and the employment of airborne troops was considered. The 1st Division of *Fallschirmjäger* was emplaned at the German airdromes and hours later was behind the Neva front, forty-eight hours after the breach had been made. The front, however, remained static for several months.

Italian Front—The Allied landings in Sicily required rapid decisions, and the 1st German Parachute Division was sent by air to Naples and from here to Catania. There they found a totally different situation. Instead of the Russian Steppe and forests covered with snow and mud, they found a burning countryside and suffocating heat.

The paratroopers had to withdraw to Calabria. In the weeks that followed, the 1st Parachute Division, incorporated into the ground troops as elite infantry, was given the mission of protecting the approaches to Calabria. After this, the Division was sent to cover the front at Cassino.

After Cassino, the Division defended the bridgehead at Nettuno, and later the Alban Hills near Rome. After the operations ceased in Italy, they continued to fight as ground troops against the invasion of the continent.

Allied Operations

Tunisia—When the Allies landed in North Africa they operated from Casablanca to Algiers, but they did not dare extend their attack to Tunisia. This would have interrupted the *Afrika Korps*' best line of communication: Sicily—Tunisia.

From Algiers to Tunisia is more than 800 kilometers. Halfway we find Bone, a good military port and airdrome, which was believed to have been reached by the Germans.

The First British Army was ordered on 12 November to occupy Bone as quickly as possible. Part of the Third Battalion of the 1st Parachute Brigade moved early on 12 November, and at 0830, arrived over Bone and jumped from an altitude of 120 meters.

The lack of preparation was felt, for the troops landed on a zone of nearly five kilometers and some cases of ammunition fell more than a kilometer short; the atmosphere was less dense than in England and the rate of fall was excessive. But the Germans had not reached Bone, and the airdrome was occupied without difficulty from the French and Moors.

Sicily—In the meantime, the Second and Third Parachute Brigades were organized in England.

Early in 1943, the assault on Sicily was being planned. The air distance to be traveled was about 550 kilometers. The assault, launched on the night of 9-10 July 1943, was by glider troops. The mission was to occupy Ponte Grande, an important approach to Syracuse from the west.

The formation started at 1848. En route it met a storm with a wind of seventy kilometers per hour, and had to fly very low over the sea to prevent being discovered by radar. It arrived over Sicily at the appointed hour and the gliders were let loose.

The invasion was discovered by the air raid warning service, illuminated by searchlights, and fired on by the antiaircraft artillery which brought down some gliders. The strong land wind prevented some gliders from reaching their destination, and they crashed in the sea. Other gliders reached land, but buffeted by the storm, some landed sixty kilometers from the objective. At the appointed place near the bridge at Ponte Grande, only one landed. Other objectives were reached with a fair degree of approximation. After landing, however, enough troops got together to capture the bridge within half an hour.

Within forty-eight hours after H-hour, the port of Syracuse had been captured. The air landing, therefore, was very useful, but costly. Originally, the force consisted of 2,758 men in 137 gliders; twenty-five disappeared or were neutralized by antiaircraft fire; another fifty fell in the sea, and only part of the crews were saved. Losses were fifty-five per cent of the matériel, and twenty-five to thirty per cent of the men.

The Normandy Landings—The airborne troops that the Allies trained for the Normandy invasion are calculated to be 100,000. On the early morning of D-day (6 June 1944), after a night of intensive air bombardment, two American airborne divisions landed in the Valognes-Sainte Mère Eglise-Carentan sector of the Contentin Peninsula. Other units landed near the mouth of the Orne River, in the Caen sector, and on the coast south of Havre.

It had been planned that armaments and ammunition would arrive in gliders a few minutes before the troops came in order to make doubly sure that they had their armament, but only some of the gliders opportunely reached their objectives. Others landed at more or less distant points, fell into the sea, or were hit by antiaircraft fire. Out of one group of 114, however, 112 reached their objective.

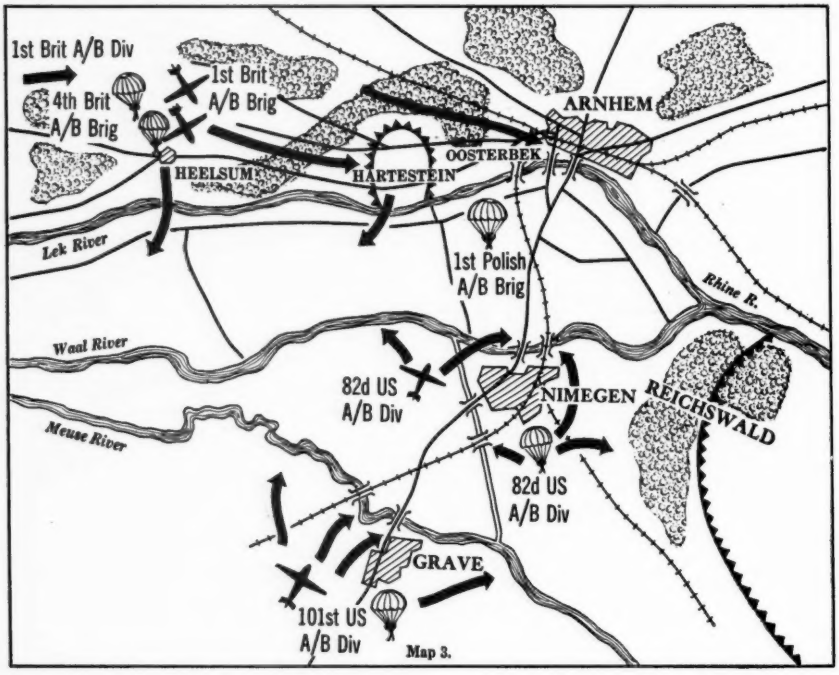
We do not know the casualties suffered by the units, but undoubtedly they were

severe. All objectives were reached, however, and this was the most important factor.

Arnhem—In August 1944, the *Wehrmacht* was rapidly reaching defensive positions in Germany, behind the Siegfried Line. As the frontal attack on this line, and the subsequent crossing of the Rhine, would necessarily be very difficult, the Allied High Command planned an enveloping maneuver of the German right flank, based on the North Sea in Dutch territory and protected by the lowlands, estuaries, and canals formed by the Meuse and Rhine Rivers and their branches, the Waal and Lek. The principal route for advancing through these deep channels was the Antwerp—Eindhoven—Grave—Nimegen—Arnhem—Zwolle road. The bridges on this road, over the Rhine at Arnhem and over the Waal at Nimegen, were almost indispensable to insure the success of the advance. For this reason, before the advance was launched and the defenders destroyed the bridges, it was decided to capture them, and the airborne troops were considered for the mission.

From 6 June to 17 September, sixteen airborne operations had been planned, and abandoned because of the rapid advance of the ground forces.

The operation was launched at 1015, 17 September. The American airborne troops reached their objectives perfectly. The 82d Airborne Division was astride the Meuse River in Grave on the 19th, thus securing the bridge intact and establishing contact with the Second British Army advancing overland. At the same time, other American units of the 82d Division were firmly established in Nimegen, securing the bridge over the Waal.



Map 3.

At mid-morning (17 September), the airforce landing in the whole sector started, and ninety-five per cent of the troops reached their objectives at the appointed hour. The troops entered Arnhem and the small enemy garrison there was soon eliminated. By night of D-day, the whole town and the bridge was supposed to have been occupied. On the 18th, engagements with weapons of all sorts took place around Arnhem, without any appreciable advance. In the afternoon of the 19th, the British had only reached the north end of the bridge and some houses in Arnhem.

In general, and even though all the airborne landings were made during the day time, there was confusion on both sides. In the afternoon of the 20th, realizing that the ground troops would not arrive, the troops in the bridgehead, almost all wounded, took refuge under the bridge and prevented it from being blown up. But they were either dispersed or taken prisoner.

On 24 September, the remaining troops promised to resist as long as possible, but on 25 September they received orders to withdraw, since the British Second Army could not advance beyond Nimegen. In the opinion of the British High Command, the failure at Arnhem was due to several reasons. In the first place, the lack of sufficient air matériel and landing strips to send the whole division in one drop; having to send the division in two echelons; and the six hour delay suffered by the second echelon due to bad weather deprived them of the shock force required initially and during the second effort.

Ammunition was dropped at designated places, but these were located in no man's land or enemy territory. Signal communications did not function, due to the loss or damage of radio equipment, and messengers had to be used. The Polish Brigade did not land near the bridge, as had been planned, but much farther away where its presence was ineffective. And lastly, the Second Army did not advance overland at the appointed time.

The Rhine Crossing—This was the first purely tactical operation launched by the Allies with airborne troops, and it was planned with unprecedented perfection.

Weeks prior to the operation, the whole sector was intensely bombarded. On 12 March, 1,100 heavy bombers dropped more than 4,000 tons of bombs on Dortmünd. On the following day, communications, transportation, cantonments, and military positions were bombarded.

At H-hour, the Second Army units started their overland march. This time the airborne forces would arrive later. In fact, they left their bases the morning of that same day. Before 1000, three hours after their departure, the airborne forces started to land.

The Second British Army, advancing overland, crossed the Rhine and established contact with the airborne units at 1000 the next morning, 25 September; but the latter had occupied their objectives since 1300, 24 September. The combined operation was a complete success.

Other Allied Operations

It is not easy to finish this résumé completely, since some of the operations undertaken by Allied airborne troops in the last days of the campaign were not given publicity or really were not combat operations, but rather, constituted an early occupation.

The effort of the troops in Bastogne, occupying the Ardennes salient, however, should be remembered. This was caused by von Rundstedt's counteroffensive in 1945. If the American troops had surrendered, they would have allowed the Germans to widen their penetration of the Allied front. This was forestalled by defending Bastogne with American paratroopers.

Earlier, there were the guerrilla operations undertaken by General Wingate

and his "Chindits" in the middle of 1943. They infiltrated the Japanese rear areas from India, and effectively interrupted supply and communications.

At other points in the Pacific, such as Wau, Lae, and the Solomons, the Americans and Australians employed airborne forces with great success.

Airborne Artillery

Digested by the MILITARY REVIEW from an article in "The Journal of the Royal Artillery" (Great Britain) January 1947.

THE number of regular officers of the regiment who have served, or who are serving, with airborne forces is relatively small. This article, therefore, is an attempt to describe the part airborne artillery has played in the past and may play in the future, and is based on British, rather than "Allied," experience.

Before describing organization and equipment, it may be well to consider the tasks likely to be given to an airborne division. The last three years of the recent war saw the development, if not perhaps the perfection, of the technique of employing airborne forces. A study of the various battles leads to an outstanding fact and that is, that no one operation bore resemblance to another in either conception, planning or execution. These differences were not so much due to improvement in technique, but rather to a better conception of the uses and the different tasks of airborne forces.

In Sicily, single brigades were dropped on different days to seize bridges some miles behind the enemy front line. A few antitank guns were flown in, and there were but few arrangements for fire support from the ground forces when the latter came within range.

In Normandy, a division was landed in two lifts with the task of securing the left flank of the bridgehead. On this occasion, a certain amount of artillery was flown in, but reliance was chiefly placed on the fire support from ships of the Royal Navy and from the guns of the neighboring assault division. This fire was controlled by a special parachute unit of forward observation officers.

In Holland, the plan was to seize bridges many miles ahead of the ground forces, thereby laying a "carpet" to quicken the latter's advance. This plan necessitated flying in the one British division of the three employed—with all its guns, but in two lifts; fire support was restricted to the one airlanding light regiment and to those air forces which could be made available; the division would not be linked up with the ground forces for at least two days, and so resupply and maintenance was to be by air.

For the Rhine crossing, the division was to be put down within range of the artillery of the ground forces and in one lift. The landing itself, therefore, would be opposed, being within the enemy gun area, but if all went well, every unit could call for artillery fire within a few minutes of landing.

Just as each of these operations differed widely one from another, so did the artillery problem vary considerably. The basic factor on which all planning rests is the available air lift. There has never been—and there probably never will be—sufficient aircraft to fly in to battle all the men and equipment that one would like. Artillery is expensive in air lift and is apt, therefore, to be the first to be cut in the allotment of aircraft.

The problem may be put in simple terms. In any operation, antitank guns will be necessary. The question is merely whether a whole regiment is required or whether

a risk may be safely taken in reducing the number of guns in favor of infantry (a glider carrying a 6-pounder, jeep, ammunition and detachment could carry alternatively thirty fully-armed infantry). The fire support problem is by no means as easy. Taking the two extreme cases: in one, the division drops well within field gun range of the ground forces; in the other, it lands beyond medium gun range, or perhaps in an area where ground forces are not likely to link up for some days. It will be seen that, whereas in the first instance there is little or no need to fly in the one light regiment of the division, in the second, its presence is vital—even at the expense of infantry. Between the two lie a whole series of conditions when careful judgment is required to balance the relative importance of infantry and guns.

Because of the limitations imposed by the air lift, it will be realized that for the airborne operation itself it is uneconomical to include in the war establishment any units other than the antitank and light regiments, together with the forward observer unit which supplies the observers and communications for using the ground force artillery. In practice, however, the airborne division has spent but the smallest fraction of its fighting days in airborne operations; man-power considerations alone dictate that the division shall fight as an ordinary infantry formation unless it is required to organize and prepare for imminent air operation. It is immediately subsequent to the landing and for the months it is in the line, that the division requires the normal artillery of three field regiments, as well as antitank and antiaircraft. In the campaign of Northwestern Europe, sufficient field and medium regiments were always made available.

There is, however, one type of operation which cannot be cared for so simply. There is always the temptation (and sometimes a requirement) to land one or more airborne divisions in an area far from our own ground forces, where it will be necessary to hold out for days, perhaps weeks. For instance, the seizure of a minor port to enable forces to be landed from the sea. It is obvious that with but one light regiment the fire support available would be dangerously meager, even were the guns of the Royal Navy available. A second regiment capable of being flown in on a second lift would be most desirable while a third regiment would of course be theoretically correct from all aspects of training, cooperation and "balance." As a counter to this, the overhead man-power charges of the airborne division are extremely heavy, and something must be sacrificed in order to reduce this ceiling to a reasonable figure; a low scale of field artillery and little or no antiaircraft resources would appear to be a sound and economical answer.

The present establishment consist of three units. The Airlanding Light Regiment of twenty-four 75-mm guns is organized and trained exactly the same as any ordinary field regiment. The Airlanding Antitank Regiment will shortly be on a normal four-battery, forty-eight-gun 6-pounder organization. Depending on the operation and type of opposition, it can be equipped to a certain extent with 17-pounders, which are carried in the large type of glider—the Hamilcar. The forward observer unit includes a countermortar section, along with three forward observation officer parachute sections, one for each brigade. This unit provides forward observation officers and all communications right back to, and including regimental headquarters of each supporting ground force regiment. Because the wireless ranges involved may well be of the order of 16,000 yards, the wireless layout is complicated, and unusual methods are employed.

Certain variations in equipment are authorized in order to conform to possible tasks. For instance, the light regi-

ment is trained basically on the 25-pounder, and is dual armed. Whereas, the 75-mm is required for a parachute or glider operation, the 25-pounder might be desirable in an air transportable role; in either case, in the subsequent battles, the 75-mm is at a big disadvantage, lacking range and weight of shell compared to its bigger brother. Antitank guns may be useless in jungle warfare or against certain types of enemy; therefore, the secondary weapon is the 4.2-inch mortar. The regiment is thus capable of flying to battle either as an antitank unit or on a mixed basis of guns and mortars, or even as a mortar regiment, thereby making a valuable contribution to offset one weakness of the airborne division—its lack of fire support.

It has been emphasized previously that no one operation is like another, nor can any one be taken as standard. It is this fact that makes the training of airborne artillery so interesting and so varied. The division must be prepared to move to war at short notice by road, by glider, by parachute, or by transport aircraft; each mode of conveyance requires its own specialized load tables and its own training; and every new type of aircraft requires fresh tables and fresh training.

All the above are superimposed on the normal training required for a field regiment with the small, but very necessary addition that all ranks must be more than just reasonably proficient in the handling of personal weapons. Without some selection of men, a reasonable standard could not be attained, but because parachuting is a job for the volunteer, a high standard of recruit is obtained.

The glider might be considered to be of less importance than formerly, for two reasons. In a future war, slow moving aircraft are likely to be easy prey to ground defenses; the glider combination is very slow judged by modern standards, and there does not seem to be much justification for thinking that its speed can be increased to the required degree. The second disadvantage is its vulnerability when landing on or near enemy-held territory; men dropped by parachute are much less exposed to heavy casualties. For these reasons—and others—airborne artillery must be ready to parachute into action, although the glider may still be considered the normal method of conveyance.

In the British service, guns are parachuted in one piece, whereas the Americans have improved their technique of dropping the gun in pieces attached one to another. The advantage of the latter method is the use of smaller aircraft. A 75-mm can be dropped in pieces from a Dakota (C-47), whereas the same gun, if parachuted in one piece, requires a four-engined bomber type. However, by using the larger aircraft and its commodious bomb bays, the complete detachment, as well as jeep, gun and ammunition can be dropped from the one plane. A certain amount of special crating gear is required, both for attachment of gun and jeep to the aircraft, and for taking the shock of landing. This crating is a unit responsibility, while the packing of parachutes is that of the RAF. In recent months, the dropping of heavy equipment has shown much progress, and exercises involving the dropping of complete troops (batteries) of guns as a tactical entity have been entirely successful. A complete detachment (including gun, jeep and ammunition) will land on the ground as a "stick" between 700 and 1,000 yards in length.

The future of parachuting men and equipment depends largely on the resources allotted to research and experiment. The main factors concerned would seem to be these. Airborne Forces employed as the new method of outflanking or enveloping the enemy are bound to be given a high priority. On the other hand, the emergence of the jet-propelled aircraft with

its high speed requires some modifications in existing methods; the individual cannot withstand the slipstream created by speeds greater than say, 150 miles per hour, without causing wide dispersion on the ground. Slow transport aircraft are feasible only when complete local air superiority is achieved, and provided the ground defenses have been neutralized, or are non-existent. Present developments indicate a satisfactory solution to these problems, at the same time suggesting that it will be possible to drop even heavier equipments, such as 17-pounders and bulldozers.

The subject is so large that this account can only touch on the more general aspects; but it is this wide scope that lends so much interest and variety to work in an airborne division. The fact that air transport and the deployment of formations by air is still in relative infancy must make an appeal to many of those who may now be regarding the army as a somewhat dreary and unexciting career.

Tank Engagements

Translated and digested by the MILITARY REVIEW from a Russian article by Major F. Lushnikov, in "Krasnaia Zvezda" (U.S.S.R.) 10 December 1946.

IN modern war, tank engagements occur constantly. They are fought by tanks in cooperation with other arms or in duels when both sides possess either tanks alone, or both tanks and self-propelled guns.

It is obvious that all arms should help their tanks by creating favorable conditions. This is done first by aviation and artillery striking at hostile tanks before they approach the range of direct fire of our tanks.

As soon as the approach of hostile tanks is detected, aviation immediately subjects them to intense bombing. Its mission is to weaken and to disperse the tank columns. Part of the hostile tanks can always break through and try to stop our forward movement. This attempt should be broken up, and the hostile tanks should be compelled to accept battle with our artillery. After the hostile tanks have been weakened and demoralized by aviation and artillery, our tanks finish the job by attacking the enemy.

Here is an example in which our tanks fought in cooperation with other troops. One of our tank regiments, operating in hostile rear areas, encountered the enemy which had quickly gone on the defensive in the vicinity of Shatkovo, Katki, and Ivanovka (see sketch). Since a by-passing maneuver was impossible, the commander, after a short reconnaissance, decided to attack. Having broken through the main line of resistance, the regiment went on. One of its groups reached Shatkovo, the other, Hill 184.6, while the third group was near Figurnaia. The advance proceeded normally, but soon the right flank unit was counterattacked by fifteen tanks coming from beyond Shatkovo and by ten or twelve self-propelled guns. At the same time, about thirty German tanks came from beyond the village of Katki and began moving quickly toward the second and third groups of our tanks.

The situation became suddenly very critical. To continue our advance was dangerous. The commander of the regiment immediately requested the supporting artillery to strike the hostile tanks in the area around Shatkovo. To help the right flank unit, he sent out two self-propelled gun batteries and ordered the second tank group to climb Hill 184.6

and meet the advancing German tanks with a fire delivered from stationary positions. To cover the left flank, one self-propelled battery was stationed on the edge of the grove near Figurnaia.

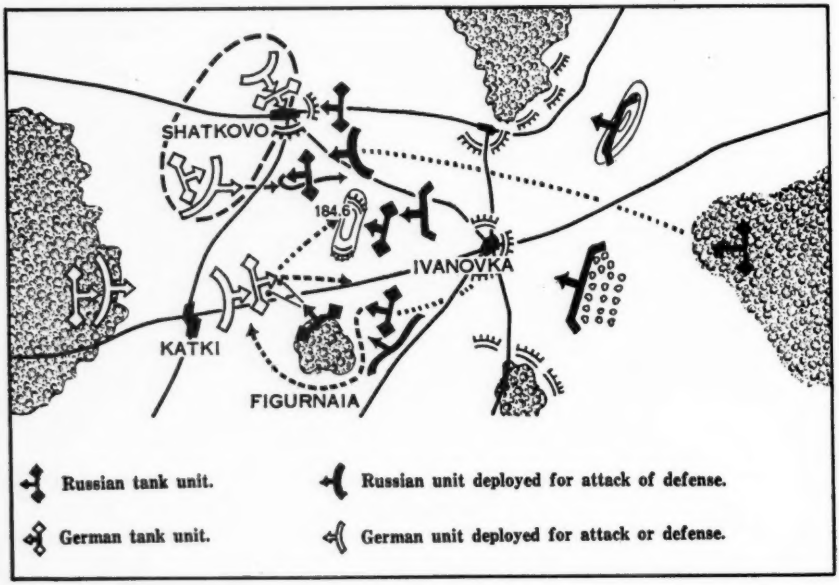
Our aircraft attacked the hostile tanks in the vicinity of Shatkovo and managed to disperse them. A battery of self-propelled guns, together with the right flank unit, completed the rout of this group of enemy tanks.

The most interesting battle was on the left flank of the regiment. As mentioned before, about thirty German tanks were moving toward Hill 184.6. As they came within range of our self-propelled batteries firing from the edge of the grove, most of the tanks were damaged and the remainder decided to hide in the forest to the west of Katki. Our third tank group went around the grove from the left and attacked the German tanks from the rear.

This example shows the correct employment of cooperative action. Success was achieved due to the timely help given by our aviation and the correct employment of self-propelled guns.

Tank engagements differ greatly from engagements fought by other arms. They unfold over a limited area and are very short-lived. Errors which have been committed usually cannot be corrected. Knowing that, one should strive for faultless tactics and take advantage of the errors committed by the enemy.

Tank engagements may take place between unequal forces of the attacker and the counter-attacker. The decision when to attack in each particular case will depend upon the situation. As already emphasized, the best time for committing tanks is the moment when the hostile tanks have been weakened by aviation and artillery, and when they are restricted by the terrain and cannot deploy. There are no definite rules for this. Tanks cannot be committed prematurely. At the same



time, one cannot delay risking the loss of initiative in the engagement.

A tank regiment on the march was trying to occupy an advantageous position and to hold back tanks and motorized infantry of the enemy moving in the opposite direction. When the march was almost completed, combat security elements reported that they had encountered German tanks and were withdrawing. At that time, the regiment was crossing a forest, and the head of the column was approaching its western edge. There was an open space beyond the forest. To the right and ahead of it, between 900 and 1,000 meters away, was a hill overgrown with small shrubs. There was a dirt road to the right of it. From the edge of the forest the regimental commander saw, within two kilometers, two hostile columns composed of tanks and motorized infantry moving directly toward him. To attack the enemy without first halting the regiment was not feasible, if one considered the strength of the enemy. But he could not let the enemy take the initiative and attack first.

The regiment was moving in column formation. Deployment would have taken considerable time. To check the enemy, the commander sent forward a few tanks to the hill. One of the tank units was ordered to deploy on both sides of the road. Another unit was ordered to block the road to the right of the unit and to meet the enemy by firing from the edge of the woods. The third group was to deploy to the left of the first.

The regiment had not yet deployed, and the German column of about sixty machines was already approaching the forest. The right flank unit and the tank group stationed on the hill opened fire almost simultaneously. The German column withdrew. In about forty minutes, their infantry having dismounted, the enemy launched a well organized attack. However, the Germans did not know either the number nor the disposition of our tanks, and particularly that our second unit was across the road to the right of the battlefield. With about a battalion of infantry and ten tanks, the enemy attacked the flank of the first unit, but as soon as his tanks came closer, they were taken under the fire by not only the tanks of the first unit, but also by the tanks of the rest of the group. The Germans, having suffered losses, again began turning around. At this moment, the commander of the regiment ordered all the groups to attack the enemy. The battle ended in a complete rout of the enemy.

Not infrequently, the situation compels the commander to assume the defensive temporarily, occupying for this purpose an advantageous position in order to meet hostile tanks by well aimed fire from a series of ambushes.

A defensive stand is most desirable when hostile tanks approach our tanks, but have not completely deployed, or being deployed, the terrain prevents us from striking the enemy from stationary positions. Attacking from a march formation is desirable when it is dangerous to wait for the approach of hostile tanks to a certain terrain line, or in cases where the terrain does not permit firing from stationary positions.

Proper timing in opening fire is extremely important. Tank engagements are fire fights, the outcome of which is determined by the time of opening fire, its accuracy, the speed of transfer from one target to another, and by its massing.

As experience has shown, gunfire in meeting engagements with tanks is more effective if it is begun at direct fire range from short halts. Such fire is more accurate. One should strive to conduct fires from advantageous positions, and fire should be combined with maneuver. To illustrate this point, let us give this example. A tank company approached a hill beyond which there was a village. When the leading tank reached the ridge

of the hill, it was fired on from the outskirts of the village. The tank withdrew. The company commander considered attacking the village by deploying from his march formation, but changed his mind after looking over the village from the hill.

Near the edge of the village stood two tanks and several self-propelled guns emplaced in firing positions. To the left of the village were concealed approaches which could be utilized for flank maneuver. The commander decided to leave three tanks on the road and engage the enemy in a fire fight in order to detract attention while the rest of the tanks circled the village to attack from the rear.

The maneuver was carried out as planned. The three tanks stationed on the eastern slope of the hill began firing on the village. In the meantime, the remaining tanks went around and broke into the village from the rear. That decided the outcome of the battle. The enemy withdrew.

On the battlefield, one cannot move without a definite purpose. Every movement, even that of a separate tank, should be carried out in the interests of fire possibilities, in conformity with the terrain and the location of the enemy. This will enable one to strike the enemy at his weakest spot.

Of extreme importance is the correct employment of troops cooperating with the tanks. Here, again, there are no stereotyped rules. One thing is clear, however, and that is that the tanks must be supported by all available means.

Cooperation of Polish Aviation with Ground Forces

Translated and digested by the MILITARY REVIEW from a Polish article by Lieutenant Colonel Weinstein in "Skrzydlate Polska" (Poland) September 1946.

THE principal task in cooperation between aviation and ground forces is to deliver aerial blows at definite times and places, thereby assisting the infantry and tanks in capturing strongpoints on the enemy's first line of defense, and in attacking in depth.

Preparation of the Attack

Cooperation begins immediately on receipt of the written or verbal attack order. The air commander, or the chief of the air staff, goes to ground unit headquarters to discuss the operations to be supported by the air force. The following points must be successively and systematically checked with the commander of the ground forces:

a. Combat mission and attack front;

b. Sequence of fulfillment of missions by individual combat units;

c. Objectives and targets to be destroyed by the air forces;

d. Methods and means of contact between infantry, armor and aviation;

e. Signals for showing the positions of friendly ground troops.

In addition, it is necessary to inform the commander of the ground forces about the capabilities of the air force, to organize the command post, and to arrange for coordination with the antiaircraft artillery.

On the basis of these points, the staff of the air unit draws up its plan for the employment of the air force and its scheme of command and liaison, and organizes the command post for the operational group. The command post is established with that of the commander of the ground forces. The individual air units then receive their orders and begin their preparation for action. This preparation includes locating airdromes close to the front, organizing observation posts on

the front line, reconnaissance by regimental and squadron commanders and command groups for the purpose of personal familiarization with the terrain, locating both friendly and enemy forces, and locating targets and orientation points.

The staff of ground forces works out a schedule based on the plan of cooperation for all the arms, including the air force. In addition, the staff of the ground forces and the air staff, work out their plan of cooperation. If the ground unit is supported by one air unit only, the plan of cooperation will be worked out by the staffs of the aviation unit and the ground forces. The missions of the air forces are enumerated in the orders issued by the commander of ground forces.

Other matters to be accomplished in preparation for the attacks include: check the understanding of the mission by units, and of signals to be used in air-ground cooperation; dispatch operational groups and their commanders to command posts and observation posts; establish radio command nets; test radio liaison; work out code tables for radiophone communications; and study maps and check the knowledge of the officers who will use them.

Attack and Fighting in Depth

Successful cooperation in attack and fighting in depth depends on accurate knowledge by air force commanders of ground and air situations, constant observation of the movements of both friendly and enemy forces, and the ability of air commanders to direct aviation to the threatened sectors accurately and rapidly. The operational group of the air force, or unit, as a rule, is with the commander of the ground army. On the Oder, the commander of the Polish Mixed Air Division and his operational group were with the commander of the First Polish Army.

The direction of attack of the combat units, the changes that occur in it, and the situation on the front, are known by the air force commander through data received from the staff of the ground unit. Nevertheless, it frequently happens that the air commander possesses data concerning changes in the situation in advance of the ground commander. This information is obtained by him from radio reports from reconnaissance pilots over the field of battle, and reports of fliers engaged in fulfilling combat missions or returning therefrom. He reports this information and his decisions to the ground commander. When we were fighting deep in the enemy's defenses, our successful cooperation with the infantry was accomplished by the skillful marking of their positions by the ground units engaged in carrying out the combat mission.

At times, the situation changes so rapidly that it is not possible to advise the air units. Under such conditions, the fliers are given the situation while on the way to the target by means of radio. In actual practice, instances frequently occur in which the group of planes receives an order for bombing areas which have been seized by friendly forces before the mission can be carried out. To prevent bombing of these friendly forces, each group flying toward the target must make radio contact with the command station and receive authorization from the commander to attack the target. Often the situation requires the rapid attack of a target that has just been discovered. Under such conditions, planes in the air are given the new mission by radio. With careful organization of cooperation, and good radio liaison, the change from one target to another does not present any difficulties, and permits the air commander to render assistance in the exact place required. Such a change from one target to another occurred during the fighting of the Polish Air Division at Warsaw, and in the crossing of the Oder.

The infantry's marking of its own posi-

tions is of fundamental importance. This renders accidental attack of friendly forces less likely, and augments the effectiveness of bombing and strafing attacks. The flier, certain that he is attacking the target assigned him, attacks with greater decision and daring.

Cooperation with antiaircraft artillery is likewise of considerable importance. During the attack and fighting in the enemy rear, antiaircraft artillery does not change its position. Flying personnel, knowing the location of their own antiaircraft artillery can sometimes lure enemy planes into areas commanded by their own artillery and, in cooperation with the latter, destroy them.

Cooperation with field artillery reduces itself, fundamentally, to guiding planes to those targets that the artillery cannot destroy. In such cases, the artillery outlines the target area with smoke shells, and the planes, thus directed to the target, destroy it.

Pursuit

Aviation usually begins pursuit of enemy ground forces when the latter's resistance has not yet been completely broken in the rear areas. The enemy usually acts quickly to evacuate his stores and technical equipment. At this time, the air forces may observe large columns on roads, concentrations of trains at railway stations, increased movement of autotransportation to the rear, and other signs pointing to preparation for retreat or retreat that has already started. Even before Warsaw was taken by the ground forces, planes of the Polish Air Division attacked the enemy's retreating columns in the Lesho-Blonie area.

In pursuit, as in the preceding stages of the attack, aviation acts first of all in the interest of the ground forces. It gives its main attention to targets whose suppression or destruction will assist the ground forces in fulfilling the mission assigned them. This is effected by precise organization of cooperation, its attacks being accurately coordinated as to target, place, and time.

There is no time for organization of cooperation when pursuit is in progress. Changes at that time only complicate existing organization between aviation and ground forces, and often lead to destruction of all tactical liaison between them.

In order to conduct operations harmoniously with troops on the battlefield during the pursuit, it is necessary that many pertinent problems be solved in advance. A very important factor is the presence of an adequate number of air force representatives in the infantry formations. A typical example of cooperation in pursuit is provided by the Polish aviation which supported the First Army of Polish Forces during the attack of Labe.

In the breakthrough on the Oder, the operations of the First Polish Army were supported by the Polish Mixed Air Division. When the operation began, the decision was made to augment the air support. For this purpose, two air divisions (one assault and one pursuit), and the direction of all air operations was entrusted to the commander of aviation, Polish Forces.

Within four days, the re-basing of aviation at airdromes near the front was finished, and by 24 April 1945, the aviation of the Polish Forces began fulfilling its combat tasks.

The enemy defense was breached, and units of the First Polish Army began the pursuit with the air forces taking a decisive part. The movement of the forces was so rapid that the aviation operational group, from 24 April to 5 May 1945, changed its command post nine times.

The operational group of the aviation commander was located with the commander of the First Army, and all questions of cooperation, assignment of combat missions to the air forces, etc., were solved

on the spot. The missions of aviation were assigned for a day at a time but, because of the rapidly changing situation, modifications were frequent.

The radio command station, with the air liaison officer, was on the front and advanced with the ground units, sending out reports concerning the situation.

In spite of the fact that cooperation was organized during the pursuit, it was so effective that all commands from the First Army were carried out within the prescribed time. The assistance which the air force gave the ground troops was often a decisive factor in the outcome of the attacks.

For example, on 27 April 1945, air units strafed and bombed directly ahead of the front of the First Army in the Dechtow area, where the enemy had consolidated his defenses and defended himself stubbornly. As a result of the air action, the enemy fire was suppressed and ground forces took the area.

On 29 April 1945, the air force, in bombing and strafing attacks, harassed and liquidated enemy forces in the Tehrbellin, Protzen, Leutucke, Frisack, Belzen, Wirhow and Neuruppine areas. The enemy suffered considerable losses and the forces of the First Army were able to push ahead.

On 3 May 1945, air forces attacked the steadily retreating enemy on the west side of the Havel river where the enemy was being consolidated. Thanks to the continuous bombing and strafing attacks of the air units, the enemy was disorganized and partially destroyed. Units of the First Army were able to force the Havel river, dislodge the enemy and reach the Labe river where they effected a junction with Allied forces.

The aviation of the Polish Forces during the period from 24 April to 3 May 1945 carried out 2,282 successful sorties and assisted the First Polish Army to complete its combat mission.

Cooperation, organized painstakingly and precisely, insured the successful outcome of both ground and air force operations.

The Future of the Armored Arm

Translated and digested by the MILITARY REVIEW from a French article by Colonel de Beaufort in "Revue de Defense Nationale" (France) December 1946.

THE end of a war usually is followed by a pause in the evolution of armament. Scientists and industrialists reorient their activities, while the victorious nations hestitate to spend large sums to modify or replace equipment only recently tested. The more remote a new conflict appears, the greater is the likelihood that new armament will become obsolete before it can be used.

This, however, does not appear to be the situation at the end of World War II.

Toward the end of the war, new but undeveloped possibilities appeared: hollow charges; flat charges; rocket projectiles; jet propulsion of planes; guided missiles; radar; loran; infra-red rays; atomic energy, etc.

The great powers are working feverishly to perfect the most effective applications of these discoveries and develop others. Peace, therefore, has neither halted nor arrested the evolution of armament. It is impossible to foresee the changes which will result from improvements and future discoveries in armament, the forms of war, or the structure of armies. Moreover, every new weapon generally gives birth to a corresponding defense, and will be more or less neutralized if the "surprise" caused by its appearance cannot be exploited decisively.

Progress in guided missiles parallels that. made in detection, and it can be imagined that progress in detection may lead to the perfection of a system of interference that will limit the effectiveness of remotely controlled planes or projectiles.

The flat charge will perhaps become the great enemy of the tank and of the plane. The rocket-propelled projectile, depending on its form, is both an offensive weapon and a counter-weapon, thanks to detection, radio guiding and automatic guiding which make it very effective when used against planes and projectiles of the V-1 or V-2 type.

We cannot, therefore, determine what the armored arm will be in ten or fifteen years. Has it a role to play on the field of battle of the near future? Under what conditions will it be able to play this role?

It may be stated that stagnation leads to impotency. It is necessary that the army continually adapt itself to new conditions of place, time, climate, armament, policy and economy. It must be emphasized that preparation cannot be limited to experiences of the last war. Lessons taught by the past can be only a guide in meeting new conditions.

This is not as easy as might be imagined. In time of war, changes can be quickly evaluated, but it is much more difficult, in time of peace, to judge the effects of an improvement or a new discovery. Thus, before 1870, the concept of fire power resulted in a doctrine of static defense. Consequently the offensive doctrine of 1914 failed to consider sufficiently the new power of the automatic weapon. In 1940, our regulations made the tank only "a supplementary means placed temporarily at the disposal of the infantry."

According to certain experts, one of the causes of the German defeat was the fact that the German General Staff did not understand, in 1940, that the revised edition of the Schlieffen plan should have been conceived in accordance with modern developments. The left of the Allied armies was no longer limited by the shores of the North Sea and the English Channel. Perhaps Hitler did not understand either, that the result of ground operation depends largely on the outcome of the fight for mastery of the air. The army that is ceaselessly attacked by enemy aviation is weakened morally and materially, and its supplies are uncertain. It loses an important amount of its fighting power and mobility.

In any future conflict, we may suppose that weapons will be more powerful than in the past, and also more effective. But it does not seem possible that fire power alone can knock out a resolute and prepared enemy. It would be a double error to believe this.

To begin with, the country that prepared only launching platforms, detecting and radio guide stations, or flying fields for its defense would be in danger, if it did not take the initiative, of seeing its preparations annihilated by rapid motorized forces or paratroops before they could be used effectively. That is the opinion of General Eisenhower, and it is difficult not to agree with him.

Also, we must not fall into the error of 1870. Fire power must be exploited if decisive results are to be obtained. This exploitation must be effected by troops whose composition and armament are derived from those used at the present time. They must finish off the enemy and occupy the vital points of his territory.

The changes that must be made in the organization, armament and employment of troops are dictated by the new capabilities of enemy fire. Large concentrations must be prohibited. Dispersion becomes more than ever the rule. Mobility must assume added importance. Airborne units may be called on to play a leading

role. Motorization becomes increasingly important. Static defense, condemned in 1870 and again in 1939-1945, is further reduced in importance. Fire, and mobile reserves employed in counterattacks, appear to remain the elements of the present defense.

We are thus able to trace the general setup within which the two questions of interest to the armored arm must be discussed: Has it still a role? Is it able to fulfill it?

Whether we examine the case offensively or defensively, the problem can be stated thus: After having avoided premature destruction by enemy preparation or counter-preparation, it will be necessary to obtain the upperhand of units equipped with automatic weapons capable of hurling mortar, artillery and explosives, and perhaps utilizing armored equipment. Face to face with the enemy, in hand to hand fighting, we shall find the lessons of the past true. Man, unprotected, even though brave and artful, would have a difficult role when facing a machine pistol or light machine gun that is well served. In such a case, no infantryman will contest the necessity of the tank.

Need for fire power and mobility, therefore, leads us to the tactical group possessing the features for local combat: the projectile (artillery or aviation) which disorganizes and prepares movement; armor and infantry for attack; and engineers for the repair of communication routes, for demining and for participation in attacks.

It is well to emphasize that armor is able to obtain the support of accurate and instantaneous fire from aviation or artillery. But will the tank still be able to appear on the field of battle in the face of the new conditions which will confront it?

It is obvious that large formations of tanks, in the rear, will be profitable targets for atomic bombs. (It is hardly necessary to call attention to the fact that the atomic bomb is a strategic weapon. It only prepares the battle. Once the combatants are engaged, it can no longer be employed.) Armor's mobility and communications, however, render dispersion easy. Moreover, the very nature of the tank permits the organization of adequate protection against certain effects of atomic energy.

It is conceivable that a modern tank should have additional protection against the high temperatures and the radioactivity of an atombic bomb. Although this protection would not be sufficient to shield a tank located in the center of explosion, with dispersion, the relatively smaller losses would probably be out of proportion to the cost of the projectile.

The hollow charge may present a considerable threat to the tank. At the present time, the range of the bazooka, *panzerschreck* and *panzerfaust* may exceed a hundred meters, but owing to lack of accuracy, they are actually not effective at more than fifty meters. The conditions under which they must be fired render the operator of the bazooka particularly vulnerable. Also, the infantry which accompanies the tanks can easily create the necessary "zone of confidence" around them. If a bazooka can be perfected which is accurate at 200 meters, the capabilities of the tank will be considerably reduced. And, if this point is reached, the tank must limit its role to that of an armored accompanying gun. The perfection of such a projectile is possible, but difficulties are certain to be encountered. The rocket projectile is very sensitive, especially to changes of temperature and humidity. Its trajectory is curved. Lastly, its volume and its weight must be limited, since it must remain a very easily maneuverable individual weapon. But whatever progress is made must be very carefully noted, be-

cause it will influence the employment of the tanks and the organization of antitank defense.

The flat charge is still in the experimental stage. It is too soon to draw definite conclusions about its possibilities, which appear numerous and extend far beyond antitank warfare. In antitank employment, the flat charge at present must be confined to the establishment of powerful antitank traps. Its small range and difficulties of camouflage, however, permit the infantry to detect it easily.

The possibilities of attack of tanks by aviation are continually increasing. They are the object of direct attacks by bombs or rockets. Supplies intended for tanks may be destroyed or delayed, but this applies to all troops and arms.

Without at least local and temporary air superiority, no important action is possible. Supply is made impossible by the loss of troops and paralysis of transportation. On the other hand, tank formations should be able to defend themselves by means of antiaircraft tanks up to at least 6,500 feet.

It is possible to imagine a projectile carrying a hollow charge, remotely or automatically controlled, capable of keeping the tank off the field of battle, but it is unlikely that such a weapon can intervene soon, or in sufficient numbers. When it is perfected, a single weapon located somewhere in the area, strongly protected, and with remote control and good observation, will be all that is necessary. Tanks, however, would still be necessary to accompany the infantry in mopping up, because close combat could not be made to conform to the conditions of fire that would exist. Thus, the tank still has a role to play on the field of battle, provided that it adapts itself to the ever changing conditions of combat.

Obviously, the strategic mobility of an armored unit is very slight in a country whose resources are limited and whose empire is vast. The less numerous the forces at one's disposal, the more mobile they should be. Can the armored arm meet the required conditions?

Nothing stands in the way of our designing and building armored vehicles that can be carried by air, since that has already been done. It will be necessary to limit their weight and volume, and consequently, their power, but they will retain the essential qualities of the armored weapon; fire power, mobility, and protection against the current armament of infantry, shell fragments, and certain effects of atomic bombs.

From all points of view, the armored arm should constitute a portion of the airborne arm, which has need, once it has landed, of armored power and mobility. Moreover, it is hard to imagine an airborne force which, once on the ground, possessed no other means of movement than the legs of its infantrymen. Partial motorization, at least, is therefore a necessity.

Should the armored arm be limited to those types of equipment that can be carried only by air? Perhaps it should for the time being, but not in the future, when France is again able to be regarded as one of the great powers. We will then need heavy equipment whose power would prevent losses and bring victory.

The remarkable tanks of 1942 and 1943 perfected by our Allies are, to a large extent, obsolete. They may still be regarded as excellent equipment for training purposes, and could even take part in a modern battle provided they were not assigned missions beyond their power to fulfill. But they can no longer hope to constitute the framework of the armored battle unit.

Modern armies have already replaced this equipment, in part, by weapons that are considerably more powerful. This equipment has been designed in accordance with the same principles as the old.

Their mechanical qualities and their combat possibilities have simply been improved. Their cannon, both antitank and anti-personnel, have been increased in power. Even more revolutionary improvements appear to have been studied, and perhaps perfected; for example, the use of infra-red rays to permit night fighting. Any war of the immediate future would probably, in the beginning, see these tanks as the principal armament of armored units.

How long a time will these tanks be of value? What will be the future tank development? It appears that studies in the improvement of tanks may follow several paths. Employment of hollow charge projectiles as tank armament would permit a reduction of the initial velocity of projectiles. The initial velocities should, however, be sufficiently high for insuring the power and precision of instantaneous, direct fire that tanks possess at present. Calibers cannot be less than 105-mm. The economy in weight would permit either lighter vehicles, or with the same weight, certain inprovements.

The use of rockets would permit further lightening the tank by the elimination of the cannon, and, to a large extent, the turret. But the trajectory of the rocket does not render aiming easy. Its relatively unstable trajectory would, perhaps, not warrant its employment at the medium ranges of combat, except in cases where they could be remotely controlled. Such apparatus could not likely be installed in all the tanks, since one of their qualities must be to remain fairly low in cost, and capable of being constructed in large numbers. It is likely that the use of the rocket, as principal weapon of the tank, will not eliminate the gun. Lastly, in the armament of the tank, the use of the flame-thrower must be mentioned as a very effective weapon for certain operations.

The concept of protecting the tank must be revised. We have seen that it would be necessary to provide for protection of the tanks against the heat and radioactivity of atomic energy. But we must also take into consideration that the power of present projectiles renders difficult the matter of absolute protection against heavy guns or hollow charges.

The tank provided with armor over 200-mm thick weighs too much. It will likely be necessary to content ourselves with protection against weapons of less than 75-mm caliber, shell fragments and the high-explosive shells of medium artillery. The best protection of the tank will be in a combination of its armament and maneuverability.

Electro-magnetic detection will perhaps permit locating antitank weapons or camouflaged tanks beforehand; and infra-red rays will allow operating at night under excellent conditions in the face of a blind enemy.

Protection against mines will always remain a serious problem. Mine-detonating tanks must be studied and improved in order to open breaches in mine fields. The tank itself must be so constructed that the explosion of a normal mine will necessitate only the repair of the undercarriage. The perfection of hollow charge mines would be extremely dangerous for the tank. The difficulty resides in the necessity for causing it to explode under the body of the tank and not under its treads, if it is to be effective. This difficulty is not insurmountable. Such mines, although not preventing the employment of the tank, would greatly increase the difficulties of its employment, and losses.

"Living in the present but at the same time preparing for the future" should be the motto of the armored arm and also of the entire army.

The army has present missions to fulfill, the preservation of the French Union, occupation of enemy countries, and

obligations to the UNO. These are the realities of today, and it is today's armament that the armored arm would be forced to use in meeting them. The necessity for meeting immediate requirements, however, will not prevent the armored arm from following all developments in order to be able to utilize them as they are brought to the point of practical perfection.

A Fascinating Parallel

Digested by the MILITARY REVIEW from an article in "The Journal of the United Service Institution of India" October 1946.

I have been greatly struck by the similarity between the closing stages of the American Civil War in 1865 and the closing stages of World War II in Europe. Indeed, the situation bears such a close resemblance that one is tempted to overstress the likeness. But this is hardly necessary. Events speak for themselves, and here is the set-up.

By the end of 1864, the American Civil War was being fought on three main fronts:

(a) In the east, Robert E. Lee, commanding the Confederate Army of Northern Virginia, faced the Federal Commander, Ulysses S. Grant, whose headquarters were with the Army of the Potomac.

(b) In the south, the Confederate, Hardee, was beating a steady retreat before the Federal, Sherman, who had just completed his famous march "from Atlanta to the sea," which he reached at Savannah.

(c) In the west, the Confederate, Hood, was in full retreat after his disastrous defeat by the Federal, Thomas, at the Battle of Nashville. The remnants of his army subsequently joined forces with Hardee, who was superseded by Johnston.

In February 1865, Lee was appointed Commander in Chief of all the Confederate forces, a function which, up to that time, had been exercised by President Jefferson Davis. In addition, Lee retained command of the Army of Northern Virginia.

At this time, the Army of Northern Virginia was strung out along a thirty-seven mile perimeter defending Richmond, the Southern capital, and Petersburg, eighteen miles to the south. This Army, which had fought a long and exhausting series of defensive actions from the beginning of 1864, until it was finally bottled up in its present earthworks, was now suffering from extremes of fatigue and lack of supplies. Grant, moreover, had unchallenged command of the sea, and a numerical superiority of roughly, two to one.

For six months, he had been trying to force a way through the Richmond and Petersburg defenses, and to finish the war by seizing the Confederate capital. But Lee's masterly handling of his steadily dwindling forces had time and again foiled Grant's plans, and, when the campaigning season of 1865 opened, the latter was still far from achieving his object.

Lee, however, was seriously worried by the increasing rate of desertion in his army. Often, in previous years, men had deserted between battles, returning to their farms to see their wives and families, and then rejoined the army before the next battle. But now they were deserting and not returning. Sheridan's successes against the Confederate, Early, in the Shenandoah Valley, from where many of Lee's men were recruited, and Sherman's irresistible advance into South

Carolina, was having the most depressing result on the morale of the Confederate troops. The call of home and family was proving stronger than the call of patriotism and duty.

Again, owing to uncontrolled inflation, the Confederate currency was practically worthless. Farmers refused to sell supplies to the government in exchange for useless paper money, and the feeding of the army suffered in consequence. The men were exhausted through overwork and continuous defense.

Lee, feeling that only by offensive action could his army retain its cohesion, made a last despairing effort to regain the initiative. The point he chose for his attack was a work called Fort Stedman, and the operation was entrusted to one of his best corps commanders, General Gordon. Lee hoped, by a successful exploitation of the breakthrough at this point, that Grant, who was steadily extending his left flank so as to threaten Petersburg from the south, would be forced to strengthen his right at the expense of his left. This would give Lee a chance to join forces with Johnston and strike at Sherman before Sherman could join forces with Grant.

Sherman, by now, was getting dangerously close, and had already reached Goldsboro.

Gordon's Second Army Corps was specially reinforced for the assault, and also given a detachment of cavalry, whose particular task was to be the destruction of Federal communications and bridges. As soon as Fort Stedman was captured, the assaulting troops were to wheel to their right and sweep down the Federal entrenchments, the movement being supported by other troops holding the Confederate lines as fast as their fronts were cleared. The attack was a failure, and can best be described in Lee's own words:

"I have been unwilling to hazard any operation of the troops in an assault upon fortified positions, preferring to reserve their strength for the struggle which must soon commence; but I was induced to assume the offensive from the belief that the point assailed could be carried without much loss, and the hope that by the seizure of the redoubts in the rear of the enemies' main lines, I could sweep along his entrenchments south, so that, if I could not cause their abandonment, General Grant would at least be obliged so to curtail his lines that, upon the approach of General Sherman, I might be able to hold our position with a portion of the troops, and, with a select body, unite with General Johnston and give him battle.

"If successful, I would then be able to return to my position, and if unsuccessful I should be in no worse condition, as I should be compelled to withdraw from James River if I quietly awaited his approach. But although the assault upon the fortified works was bravely accomplished, the redoubts commanding the line of entrenchments were found enclosed and strongly manned, so that an attempt to carry them must have been attended with great hazard, and, even if accomplished, would have caused a great sacrifice of life in the presence of the large reserves which the enemy was hurrying into position.

"I therefore determined to withdraw the troops, and it was in retiring that they suffered the greatest loss. I fear now it will be impossible to prevent a junction between Grant and Sherman, nor do I deem it prudent that this army should maintain its position until the latter shall approach too near."

This assault took place on 25 March 1865, and the survivors of Gordon's attacking troops were back in their own lines within four hours. The Confederate casualties were about 4,000.

With his last hope of seizing the initiative from Grant irretrievably lost,

Lee now had no alternative but to pull out of his extensive fortifications, which he no longer had the troops to man. On 2 April, the withdrawal from the Richmond and Petersburg defenses began. Grant followed up like lightning, and a week later, on 9 April he had, without the aid of Sherman, captured or destroyed the whole of Lee's once great army. In the final surrender at Appomattox Court House, 28,356 officers and men of the Confederate Army were paroled.

With the surrender of Lee's army, the Confederacy collapsed. The only organized force left was Johnston's in North Carolina. He concluded an armistice with Sherman on 18 April, and 37,047 men were paroled in the final surrender. Jefferson Davis, the Southern President, was himself captured on 10 May, and all fighting ceased on the 13th.

History Repeats Itself

In December 1944, the situation confronting the German Armies was as follows:

(a) In the West, manning the Siegfried line, Runsted's army faced Eisenhower.

(b) In the East, Guderian faced the Russian, Zhukov, who was pushing steadily nearer Berlin.

(c) In the South, in Italy, Kesselring faced Alexander.

The German armies in the west had been in continuous retreat from 6 June, when the Allies landed in Normandy, until they managed to halt the Allied advance when it reached the Siegfried Line. Eisenhower then started a series of frontal attacks at different points in the line. He had unchallenged air supremacy, and a large numerical superiority. Some observers estimated that these bludgeon blows were costing the Germans some 6,000 men per day, and, although the amount of ground gained was small, yet Runsted realized that he could not afford to suffer such a casualty rate indefinitely. Sooner or later his army would crumble away. Desertions were increasing, facilitated by the chaos created behind his lines by the incessant Allied bombing. Many of his troops who came from East Prussia were already "looking over their shoulders," as the Russians invaded their homeland.

In these circumstances, he, too, made a last despairing effort to regain the initiative. He hoped to break the Allied grip on his army, so that he might join forces with Guderian and strike at Zhukov, before the latter could unite with Eisenhower. The point chosen for the attack was in the Ardennes, with the object of creating a diversion at a weak point in the Allied lines and seizing Liege and Namur. If these successes could be exploited, Antwerp and Aachen would be threatened.

To a limited extent, this thrust was successful. It certainly caused the Allied commanders to regroup their forces. Everything was concentrated on the destruction of Runsted's few remaining Panzer units, to the detriment of other attacks on the Siegfried Line which were then in progress. But the initial breakthrough failed to reach any tactical objective, and the advance was halted four miles north of the River Meuse.

From this moment onwards, it was only a question of time before the ground lost by the Allies was regained. Runsted, having shot his bolt, now had no alternative but to pull out of the Siegfried line, which he no longer had the troops to man. His efforts to unite with Guderian were unsuccessful, and the German armies, like the Confederates, were forced to surrender independently.

Internment Camps

Digested by the MILITARY REVIEW from an article in the "Weekly Information Bulletin" (Office of Military Government for Germany, U. S.) 20 January 1947.

ELEVEN civilian internment enclosures in the U.S. Zone of Germany, formerly maintained by U.S. forces for the detention of Germans in the automatic arrest categories, have now been handed over to German authorities for direct administration. War criminals and others specifically wanted by U.S. authorities have been transferred to Dachau and will remain under U.S. custody. At the projected rate of trial by denazification tribunals established or being established in the German operated enclosures, each of the approximately 45,000 internees will have been tried by the end of 1947, and either sentenced or acquitted.

On 13 July 1946, U.S. Forces, European Theater (USFET) directed the transfer of these enclosures and the internees, with the exception noted above, to the German Ministers for Political Liberation for the administration and processing of the internees in accordance with the provisions of the Law for Liberation from National Socialism and Militarism, which was passed in identical form by the three *Laender* in the U.S. Zone on 5 March 1946. This is the law which provides for denazification by the Germans themselves.

In the eleven enclosures are interned those who have been arrested because of membership in the four organizations which the International Military Tribunal found to be criminal—the Elite Guard (SS), Secret Intelligence agents (SD), Gestapo, and Leadership Corps—and also those who were members of the Storm Troops (SA), the Reich Cabinet, and the German General Staff. Most of the automatic arrestees in the enclosures will be charged as offenders or major offenders. All internees will be processed by the enclosure Tribunals (*Spruchkammern*) before being released or sentenced to a work camp. Exceptions have been made in the case of persons so ill or disabled that medical approval can be obtained for their release for trial by a local tribunal outside the enclosure.

German Responsibility

German denazification officials of the Ministries for Political Liberation of the three *Laender* are solely responsible for the administration of the enclosures and the trial of those interned there. Military Government interests itself in the enclosures only to the same extent as in other government operations conducted by the Germans, exercising the functions of liaison, observation, consultation, and inspection. In discharging its responsibilities with respect to inspection, it reviews all the cases which are tried in the enclosures, reports upon the progress of the trials, and evaluates the administration of the enclosures.

The present capacity of the enclosures is about 51,000. Although those currently detained number only approximately 45,000, it is estimated that when all tribunal cases in the U.S. Zone have been tried, more persons will be sentenced to hard labor than can be confined in these enclosures. This will probably necessitate an increase in the capacity of the present enclosures. In addition, other camps are being constructed near future work projects. Already work is under way on three such camps at Stuttgart, Munich and Kassel.

Largest Enclosure at Darmstadt

The largest enclosure under German administration is the one at Darmstadt, which houses 11,000 internees. Wuerttemberg-Baden and Bavaria have five enclosures each. Latest available figures showed that 27,000 former members of the

SS and 16,000 members of the Leadership Corps were interned in the enclosures. The remaining internees were practically all members of the other automatic arrest categories.

Although the directive implementing the transfer of the enclosures was promulgated early in July, the multiplicity of details involved in such an operation resulted in the transfer actually being made only within the last three months of 1946. Careful inspection was necessary to make certain that the Germans taking over would be able to maintain security. Supplies had to be provided to sustain the enclosures for a period of two months until the Germans could put their own supply system into effect. Arrangements had to be made to clothe guards and provide weapons and medical equipment through American supply sources.

Low Escape Rate

Despite a shortage of well-trained guards and new administrative personnel, the escape rate during November and December was less than one-fourth of one per cent per month. There was a total of 200 escapes from among the 45,000 internees. The enclosures now have 3,000 guards, three-quarters of estimated requirements.

Each enclosure is supervised by a camp leader (*Lagerleiter*) who is aided by non-Nazi employees and certain internees, regarded as "trustees," who had been used in the same capacity when the enclosures were under U.S. control. At Darmstadt, a U.S. Military Government officer and a staff of Military Government employees are stationed in the enclosure to discharge the responsibilities of Military Government, and plans are being made for similar arrangements in other enclosures. In each enclosure, internees have elected a *Burgomeister* and council to work with the administration.

Personal welfare of the internees has been of primary interest to the German authorities, and is regarded as one way to minimize the security hazard. Medical attention is furnished by interned doctors. A plan for providing food for all internment enclosures has been set up by the *Laenderrat*, furnishing the same food as is available to German civilians outside the camps; but each internee is required to work a certain number of hours a day on labor details to earn his food. The enclosures have organized symphony orchestras and theaters, and one camp has built a club for evening entertainment. To all, church facilities are available. Mail and package service is practically unrestricted.

One primary purpose of the German authorities in charge of the enclosures is to implement denazification trial procedures. Of the fifty-four Tribunals estimated to be required, about sixty per cent are functioning. Already 1,000 trials have been completed, and a maintenance of the rate anticipated when the program is fully operative should result in all internees being tried, and sentenced or acquitted, during 1947. The charge and final decision in respect to each case are reviewed by Military Government, and where it is felt that the tribunal has not carried out the spirit and the letter of the law, the matter is discussed with the public prosecutor concerned. If he does not wish to reopen the case, the facts are presented to higher Military Government authorities, who may require the Minister for Political Liberation to make arrangements for the reopening of the case.

Psychological Warfare

Translated and digested by the MILITARY REVIEW from an article by Captain Raul Yazigi Jáuregui, in "Revista de la Fuerza Aérea" (Chile) October, November, December 1946.

BEHIND the façade of war that employs all the usual weapons, there exists another weapon which uses emotional and intellectual methods against both combatants and civilians. It is called psychological warfare.

The application of psychology to the armed forces acquired unusual importance during World War II, and its proper application to military strategy and tactics contributed greatly to the fighting power of the armies.

Various countries, notably Germany and Japan, created psychological institutes to collaborate with their General Staffs. The psychologists charged with these missions possessed ample professional background and technical knowledge, from the military standpoint, to qualify them for their duties.

The importance of this subject is readily apparent from the problems with which it deals. These include:

1. Defensive Psychology, which deals with the psychological organization of the Armed Forces and the selection of personnel in peace time, as well as the psychological preparation of the home front for war.

2. Offensive Psychology, including:

a. Psychology of war instruction and training.

b. Combat psychology.

c. Psychological influence over the enemy.

d. War of nerves and propaganda.

Defensive Psychology

The fundamental basis for the organization of an armed force is to improve (1) the technical preparation of personnel, and (2) its war potential. Since these two factors combined increase the possibility of victory in case of war, psychology must be given great importance. Nothing inspires greater confidence and security in the human being than to know that he possesses a good technical preparation and sufficient means to protect himself.

Psychology requires from the officer certain mental advantages qualifying him to assume command. In addition, modern weapons, specially planes and tanks, must be operated by individuals having a special temperament, great physical strength, stability and vigorous personality.

Psychological Preparation of the Home Front—Modern war requires participation by the whole nation. In this kind of war, final victory depends greatly on the positive or favorable attitude of the civilian population. This requires, during peace time, the development of a certain intellectual and emotional attitude in the public towards war.

To achieve this objective, war psychology requires the modification of educational and pedagogical principles, fostering their development in the desired direction (guided education). The psychologists of the Armed Forces are called on to study and apply this new educational policy. It requires the formation of a martial spirit, an ample physical education program, fire practice, development of civil aviation, and closer relation between civil and military institutions.

The study of history is imbued with national sentiment and the establishment of a firm patriotic tradition. Arithmetic is also taught in terms of military science, including ballistics, military geometry, and naval mathematical problems. Elementary principles of aviation mechanics, plane models, etc., are also taught.

This educational system tends to give the youth of a nation a definite emotional and intellectual orientation. It facilitates the evolution to a more advanced age without the confusion of principles or conflict of ideas, exaults the sentiments of honor and loyalty, and developes the ability to command.

Offensive Psychology

As to the education of troops, today's attitude contrasts with that which prevailed during World War I, which required blind obedience to military instruction. Personal initiative was unacceptable, especially during combat. The soldier was always to act in accordance with the orders he had received from his superiors, but this same war proved the necessity of independent action, at times, for which the soldier had not been psychologically prepared. This is the reason why it is now considered necessary to transform the education of the soldier, creating a new kind of fighter, who is capable of complete subordination and discipline, but able, at the same time, to display initiative, and make independent decisions when circumstances require.

Military maneuvers are of great help in putting these ideas into practice, and they should be conducted by imitating battle conditions as much as possible. Soldiers should go over obstacle courses, learn to take advantage of the terrain and try to keep up the advance in spite of physical or mental fatigue, especially those that belong to shock units.

Combat Psychology—The purpose of all this training is to increase the fighting spirit of the troops. Courage and cowardice are psychological factors which can be modified. Courage must be developed even in individuals who are apparently timid.

Another important factor which increases the fighting morale of the soldier is a conviction that war is essentially offensive, while the defensive is only the proper attitude of a civilian towards war. Psychological warfare, therefore, stresses the offense and rejects the defense as a method of war.

It has been proved that inaction reduces the fighting spirit of troops. This was noticed especially during the trench warfare of World War I. It is, therefore, recommended that men be continually transferred to more active places. Another curious phenomenon observed during this war, in outposts, especially when the personnel felt itself isolated from its own forces, was the developing of a sense of depression and isolation, believing that the job they were doing was worthless. As a result, such troops were easy prey to hypochondriac ideas and pessimistic thoughts, ending in loss of interest, disregard of duty and surrender to the enemy.

Psychological Influence over the Enemy—The practice of improving the morale and fighting spirit of our own troops must be coupled with undermining the morale of the enemy. This is one of the purposes of modern air bombardments. The effect of such bombardment shows itself in a rapid reduction in the will to fight or resist. Panic develops as communications systems and power plants are destroyed.

It is hard to stop the spread of panic once it starts. It is extremely contagious. It is better, therefore, to forestall it by careful training, and instructing the troops in what they may expect. It is also necessary to know the enemy thoroughly from a military, as well as a psychological, viewpoint. At times, religious influence constitutes a favorable psychological barrier, constituting a real moral refuge when facing danger.

War of Nerves and Propaganda—World War II marked the end of traditional concepts and techniques. Three fundamental factors characterized these changes: (1) Invention and improvement

of new weapons, especially mechanized weapons; (2) the intervention of the civilian population; and (3) the change in the objectives of war, to include new ideologies in conquered countries.

To develop this new type of warfare, special agents are sent to exploit the rivalries between divergent social classes and minority groups, the ambitions of politicians, racial controversies, and social and economic inequalities. These agents establish close contact with individuals who sympathize with their ideology, and engage in sabotage and espionage. Such agents are very carefully selected. They should be highly cultured, have a pleasing personality and strong patriotism. These psychological spies are real artists in their profession, greatly devoted to their work, completely adaptable to their environment and possess a fanatical desire to serve their country.

The final objective of this campaign is to influence and confuse public opinion, and destroy the confidence which the enemy has in its government and its power.

To accomplish this objective, press and radio propaganda is employed, and rumors, disloyal commentaries, or deliberate lies are spread. Rumors and anecdotes have just as much influence on public opinion as the press, and they spread with the same speed. Neither denials nor silence can effectively counteract the effect of rumors.

In other cases, fighting troops are influenced through the home front, by spreading disloyal rumors about immoralities, war profiteering, etc.

The public and private lives of politicians and statesmen are studied to find favorable or unfavorable antecedents. When it is necessary to elect an individual with ideological tendencies favorable to a particular cause, his merits are pointed out and other good qualities attributed to him. On the other hand, if it is desired to drive someone from power, all instances detrimental to him are exploited.

No nation is at present in a position to ignore these facts. Such propaganda is organized in peacetime, functions during the pre-war period, and bears best results after the break of diplomatic relations.

Although these methods cannot be reconciled with honor or dignity, we must understand them in order to defend ourselves. Their application is justified, only because, at times, they contribute, as all psychological warfare does, to hasten victory.

The individuality of the superior commanders and diversified interpretations that are revealed in the field, still leave, in each case, a large field open to misunderstanding. And it will only be by the development of a common doctrine of war, that these difficulties can be done away with, in part.

A Defesa Nacional **(Brazil)**

Communications—A Weapon of War

Translated and digested by the MILITARY REVIEW from a French article by Lieutenant Colonel Combaux in "Revue de Defense Nationale" (France) October 1946.

COMMUNICATIONS had already accomplished many miracles by the time World War I occurred. The telegraph was in use in the majority of countries. Submarine cables had successively joined Europe, Africa, India, China, Australia, and South America. The United States, in its expansion toward Asia, was joined in the Pacific with Australia, India, China and Japan. These networks fuzed together the various lines of political and commercial intercourse.

The telegraphic line did not transmit decisions of state alone. It transformed the world into one market, and the prime concern of nations became commerce. For a long time, the telephone had been limited to local or national communication. In 1910, the use of the triode vacuum tube extended its range to the furthest reaches. While the telegraph and telephone required wire conductors over the entire extent of their networks, radio (1899) was free of this constraint, and it began immediately to vie with the telegraph cable in continental relationships, and underwent its first tests aboard dirigibles and airplanes.

Developments of this sort had, in truth, given birth to a new weapon—signal communications. Together with aviation and armor, it was one of the great innovations of World War I. For the first time in history, armies of several million men over extensive fronts opposed the Central European Empires in a world alliance of nations. In that war, the telephone and the telegraph, well adapted to the slow tempo of the operations of that time, constituted the principal means of communication.

But radio was rapidly extended. In order to insure the long-distance communication necessary for Allied diplomacy and strategy, large fixed stations were constructed, while mobile sets were rapidly provided for armies and corps. Military planes were equipped for artillery fire direction and reconnaissance. Broadcasting of weather reports helped aviation and artillery.

Until after the defeat of 1940, the French Army maintained the signal service of the Ground Forces as a special branch of the engineers. In the Navy and in Air Forces, a similar error was committed. Communication, the common weapon of all the branches of the armed forces, was denied any deep-rooted unity.

In other countries, however, particularly in Germany, England, and the United States, "signal corps" were created. The military technique of signal communications developed by thousands of engineers with government direction, was prepared for modern war. Military signal communication would not have been able to play the role it did in World War II, if considerable progress had not been made since 1918 to increase the quantity, power, and employment of its equipment.

Communication by wire was not well adapted to rapid movement. It was vulnerable and limited in range. Little by little, insulated overhead conductors or conductors buried in the ground replaced heavy overhead lines of bare wire which the least bombardment disturbed. Mechanical means permitted installing them rapidly. Field amplifying stations were created, and long-distance telephone thus came into current use in all armies.

Teletype replaced in part, the old Morse code of the telegraph. Radio wave-lengths were expanded permitting lighter and less cumbersome equipment to be used. Manufacturing specialization in miniature sets had still further reduced weight and

volume of equipment. Great precision in frequency has been attained, and it is possible not only to tune ten or eleven sets to work together on the same wave length, but to construct sets which will operate on several predetermined wave lengths.

The construction of directional antennae for use with short and ultra-short waves permits concentration of the radio-electric energy into narrow beams. These invisible beams open an immense field to radio. Modulated by impulses, and combined with cathode-ray oscillographs capable of registering, in visible form the infinitesimal interval between the time of departure and return of a radio wave reflected from an object, they gave birth to radar.

In the war which began in 1939, communication by wire no longer possessed the predominance it had had in 1914 when the fronts were stabilized. Technical developments had more influence on general strategy than on the tactics of the various arms. This strategic character was already found in the expansion programs carried out by the German Army in its underground networks in the Reich and occupied territory. But it was still more pronounced in England. This country was faced with the task of maintaining numerous interior connections required for her air defense, her industrial mobilization, the preparation and surveillance of her convoys at sea, the equipment of the gigantic airfields for her bombing squadrons, the recruiting and organization of her expeditionary forces, and the preparation of the continental invasion.

At the same time that England maintained her civil system in a state of full efficiency, she constructed more than 9,300 long-distance telephone lines, 10,000 telegraph lines, and 60,000 installations for her military organizations. Her underground network was doubled in the midst of the war. Less than three days after the landing of the first elements in Normandy, a telephone and telegraph cable had been laid across the Channel between Southbourne and the Longues beach in France. A second cable was added by 17 June. Two others connected Swanage to Querqueville by 30 and 31 July. After the complete liberation of the French coast, four cables were laid across the Strait of Dover, one of which could handle sixty harmonic channels which extended over our own networks to Paris. In October 1945, England was connected with France by more lines than there had been in 1939, 220 telephone and 170 telegraph lines.

It was particularly in the field of aviation and in the navy that the revolutionary capabilities of wireless communication were demonstrated. As soon as the air menace appeared, England applied herself to defense. Great networks for the transmission of information and alerts were organized. Short-wave radio apparatus working on pre-selected frequencies gave perfect flexibility to the maneuvers of her Spitfires and Mosquitos.

Radar was discovered by England around 1935. By 1938, she was equipped with a powerful chain of radar sets along her coasts, and in 1939, her night fighters were provided with similar apparatus to be used in flight. When, on 8 August 1940, the Luftwaffe began its attacks on England, its losses were so heavy that it immediately suspected that the adversary had in his possession some mysterious instrument which served to alert and guide him. The British fighters, numerically inferior to the attacking enemy, were warned by radar on the ground and guided to the enemy. German aviation had been beaten. The Islands were saved, and communication was able to claim a large share in this victory. The initial success was followed by extraordinary developments.

When Allied aviation changed over to the offensive in powerful night bombing operations, it was obliged to equip its

bombers with accurate navigational instruments, and to dispatch reconnaissance planes capable of spotting their targets in any weather. New navigational systems were devised such as the "Gee" and the "Loran" systems, which consisted of chains of three or four stations emitting impulses out of phase with one another. With ranges of 300 miles for the "Gee," and 600 to 1,200 for the "Loran," these stations provided an invisible network by which the bombers found their positions accurately.

When beyond the range permitted by this method, radars designed for exploration of the surface of the ground came into play. Such sets gave the navigator an optical image of the terrain over which he was flying. The shadow of the flying fortress was thus suddenly extended to cover the whole of Germany. On 3 November 1943, and in bad weather, nine pilot planes guided a raiding formation of 540 bombers over Wilhemshafen. The following month the Eighth Air Force alone unloaded 24,000 tons of bombs on enemy territory with remarkable precision. In addition to their navigational instruments, the air fleets also carried an extraordinary assemblage of radio equipment of every sort necessary for command, fire, and liaison. Thus, a heavy bomber might carry more than ten different sets of apparatus: radio-telegraph, radio-telephone, interphone set, navigational receiver, bombing radar, altimeter radar, tail alert radar, apparatus for identification of friendly planes, blind-landing instruments, and defense radars used in the control of the gun turrets. In fact, when the Allied air fleets took off for the Continent, filling the London skies with their roar for several hours at the close of day, communications controlled them.

Naval operations presented problems in communications that were just as complex as those met in aerial warfare. The defense of a battle fleet, which must protect itself against the approach of enemy reconnaissance and observation planes and repel the attacks of heavy bombers, dive bombers, torpedo planes, glide bombs, submarines or surface craft is in some respects more complex than defense of a land zone. Rolling, pitching, and change of direction complicate ships' firing problems. Single-seater naval planes without navigators were in danger of losing their way and failing to return to the moving runway of their carriers. Hence, they were not long in being supplied with means comparable to those in the air forces proper.

The problem of radar detection of ships and surfaced submarines by coast defense planes was solved in 1941. Almost immediately, explorational radars were installed on ships. Short-wave radio-telephone from the ships was applied to the problem of guiding the movements of the defensive fighter aircraft. Still later, the application of radar to central firing permitted the automatic point of guns, taking into account corrections relative to altitude, wind, and speeds of the targets, ship and projectile. Finally, single-seat aircraft were equipped with a light interception radar set, which pilots could easily use. So great was the multiplicity of means employed, that a battleship of the *Iowa* class (45,000 tons) possessed no less than eighty radar sets. Thus, around the ship, communication silently sounded both sea and air.

With the advent of surface radars, crushing naval superiority was manifested by the Allies. In the Pacific, one squadron of B-24s belonging to the 14th American Air Force and operating at night, sank 110,000 tons of Japanese shipping in thirty days. In the Atlantic, convoy losses dropped to one ship in a thousand. The German submarines were not able to surface for air or to recharge their batteries without being immediately detected and pursued. When they attempted

to pick up the radar signals so as to be able to submerge and disappear in time, the signals dropped to frequencies shorter than they were able to detect. In the autumn of 1944, the German Navy had but one defense left in its efforts to save the last of its submarine fleet: the *Schnörkel* tube which permitted them to run their diesels without coming to the surface. Mastery of the seas had definitely been acquired by the Allies.

World War II was profoundly different from World War I. The latter was essentially a linear war. The depth of the field of battle has been limited to the range of the artillery, while the fronts extended for thousands of kilometers. The railroad was the principal means of transportation. We have seen how, in that war fought in frontal battles of limited depth, the telegraph and the telephone constituted the principal means of communication and added to the rigidity of the whole.

In World War II, motorization accelerated concentrations, tank armament acquired irresistible power, and aviation entered the battle.

In this confused melee, communications weaved the bond of unified thought between the scattered elements of modern armies, and fuzed the individual actions carried on from one end of the immense field of battle to the other into a single battle, and at a speed ten times greater than in 1914. Communications became the third fundamental element of war, as fundamental as fire and movement.

Out of necessity, liaison by radio has moved down from the most important command posts to the smallest units. The number of networks is increasing. There are more than 1,000 radio sets in an armored division, and among these sets, there are many which, by the simple manipulation of push buttons, permit operations in several networks, multiplying the number of possible contacts. The colonel of a tank regiment may, in this manner, tune in successively into his command network, the interior network of his companies and those of the infantry and tank destroyers. He may speak to all and all may speak to him.

These powerful connections on the ground are completed by connections with the air force. In modern battle, superiority in the air is necessary for superiority on the ground. Aviation does not intervene in direct support only. It must, in addition, prevent reinforcements from arriving on the battlefield. Radio and radar are the principal instruments in this air-ground cooperation. The latter increases the precision of the tactical as well as strategic bombardment, while the former connects the air liaison detachments of large ground units with the formation in flight. After September 1944, American tactical aviation maintained a watch from the ground by radar over the exact position of its fighter-bombers, and guided them by radio to targets visible only to observation on the ground.

In its effort to carry the battle farther and farther, communication has extended its action into the enemy's rear areas to direct the movements of airborne forces as in the German invasions of Holland and Greece, and the Arnhem operation of the British. Such operations would have been senseless in 1914 with the inadequate communications of that time.

But what are such exploits compared to the role of communications in the liberation of France? The powerful central station in London picked up the feeble broadcasts of the resistance sets. Secret sets connected the agents landing on our Channel coasts with England. "Eureka" sets placed in the drop zones served as beacons to Allied planes charged with the dropping of supplies and weapons to the patriots.

During the liberation, with perfect synchronization, two theaters of opera-

tion were opened in Normandy and Provence in conjunction with the program of national uprisings.

Let us next consider the battle of communications itself. Not to know the battle waged by both sides for the conquest of the other, would be lack of knowledge of one of the most remarkable innovations of the war. Radio broadcast listeners will remember the efforts of the *Wehrmacht* radio jammers trying, on all wave lengths, to cover the increasingly powerful voice of the British radio. But the majority of listeners were unaware of the battle -waged in the same domain by the laboratories, secret service agencies and powerful, radio countermeasure organizations. The RAF countermeasure agency comprised more than 10,000 persons, 4,000 of whom were technicians. Instituted at the beginning of the battle of Britain for the purpose of interfering with the radio beams followed by the *Luftwaffe*, it passed over to the offensive at the same time as the RAF, and attacked simultaneously enemy air-warning systems, AA defense radars, and the radio-telephone liaison of the German night fighters. Its fleet of jamming planes: four groups of four-motored bombers and seven groups of Mosquitos, paralyzed the radio communications of the defense, and dropped light metallic foil in the skies to confuse enemy radars. It thus led the *Luftwaffe* away on false trails, then neutralized its landing fields and lay in wait for it as it landed.

Likewise, in the technical struggle, the communications of the Royal Navy were opposed to those of the *Kriegsmarine*, and determined the outcome of the Battle of the Atlantic. The simple capture of a surface radar in September 1942, gave the German submarines the secret of detection, and permitted them, for several months, to escape the blows of the Allied navies. When the latter had again resumed the lead, thanks to a new detector operating on ultra-short waves, German science made the greatest effort to discover the nature and the length of the waves employed by the new equipment but failed.

Today, though the war has ended, the battle of communications continues. The employment of longer and shorter wave lengths is becoming a more and more accepted and wide-spread practice. The problem of radio control is being feverishly studied. Applied to self-propelled projectiles, naval torpedoes, glide bombs and V-2 rockets, it has already begun to revolutionize artillery. The possibilities of communications are limitless. It is an extremely fascinating subject to study. Its uses in future warfare can only be imagined, if another war must be fought. Humanity alone can determine whether these great developments will be put to evil use or to furthering the advance of civilization through peaceful pursuits.

In getting a mission accomplished, ordering it is ten per cent and seeing that it is done is ninety per cent. Inspect and check, but never issue an order that cannot be carried out.

Revista Militar (Bolivia)

Regiments or Brigades?

Reprinted by the MILITARY REVIEW from an article in "The Owl" (India) December 1946.

THE organization of the British Dominion and Indian Armies differs in one respect from that of the armies of most great powers. Our active formations are composed of brigades, the three battalions of which normally come from different regiments. In other armies, the regiment consists of three battalions, and takes the place of our brigade in fighting formations. It is difficult to understand why we do not adopt this practice.

Our present system is a legacy of the Cardwell Reforms of 1871, when the Army was reorganized, the primary object being to maintain garrisons abroad under peace conditions. The linked battalion system thus came into being; this of course made the brigade rather than the regiment figure in the order of battle. To me it seems that "linked regiments" would serve the same purpose; an interchange of personnel between regiments could take place. There might be friction between these regiments for the first few years of the new organization, but this would be temporary, and bonds similar to those existing between battalions today could be forged between the sister regiments. The subaltern, transferred from one regiment to the other, might perhaps be told that he is not in the "Loamshires" now, and that things are done in a very different way in the "Chalkshires"; just as, under the present system, his new adjutant may advise him to forget what he learned in the second battalion, now that he has had the good fortune to be transferred to THE Battalion of the regiment, where a very different standard obtains.

The strongest argument against the regiment as opposed to the brigade system is, to my mind, that it causes concentration of casualties. This has a twofold effect. First, when a brigade suffers badly, its casualties are divided among three regiments; these regiments are faced with the problem of reinforcing one depleted battalion instead of three. Further, from the point of view of the "home front," casualties to a three battalion regiment, drawing its men from the same area, would lead to hardship and a drop in morale in the district affected. This was well illustrated in the last war, when the Welsh Division was badly mauled in 1944. The sudden incidence of casualties on a large scale, among families in a thickly populated and depressed area, had an extremely adverse effect on civilian morale. This factor is undoubtedly a weakness in the regimental system.

Another argument which supporters of the existing system may raise is that at present, battalions can be grouped or regrouped rapidly into brigades, to meet changing circumstances. It may be argued that this system gives greater flexibility than the alternative, but there can be no doubt that the latter will insure far greater efficiency and cooperation. In the three battalion regiment, officers and men would train and fight together, with all the gain in teamwork which this implies. The arbitrary amalgamation of three strange battalions to form a brigade would thus be the result of peculiar or desperate circumstances, rather than the normal practice.

The two main disadvantages of the regimental system, therefore, are the danger of concentration of casualties, and some loss of flexibility. I feel that the two great advantages of the system which I propose, those of enhanced *esprit de corps* and ease of administration, far outweigh those disadvantages.

We all recognize that morale is an essential quality of an army. The regi-

mental spirit and the *esprit de corps* which it produces are essential factors in the maintenance of morale. I feel, however, that *esprit de corps* should hold together as large a body of men as possible. Healthy rivalry among small bodies of men can quickly degenerate into distrust and contempt. The ideal is an army rather than a regimental spirit, such as the Eighth Army achieved and which played such a large part in its success. In peacetime, however, an army spirit is not practicable, but a regimental spirit can and must be maintained.

In war, the improved team work in a regiment going into action as a unit would be of inestimable value. As it is, battalions from three different regiments with three conflicting loyalties are brigaded together. As the belief that all other regiments are rather second rate is a natural corollary to the confidence that one's own unit is the best in the army, some friction and mutual intolerance may attend the initial composition of a brigade. It is true that after a few months of service these will, as often as not, disappear, and be replaced by mutual admiration and confidence; but should the first action produce an incident which may be construed as one of the battalions letting another down, the old narrow views will prevail, and you will hear such remarks as "we knew that the 'Mudshires' would run." These remarks will not be confined to the brigade; as remarks about a weak company will be strictly confined within a battalion, or about a weak battalion within a regiment. Even under the best circumstances it will take some months to establish firmly, the brigade spirit; and when brigades are broken up and reorganized, the process will have to start again. In this, as in so many other spheres, our present policy involves starting a war with an untried weapon, forging that weapon to perfection by the expensive method of trial and error, and throwing it aside when the immediate necessity has passed.

A regiment will be subject to none of these growing pains. Battalion spirit will be a competent part of regimental spirit, whereas in the brigade it may have to be modified if a brigade spirit is to be achieved. Bonds formed in peace will be strengthened by success in battle, and will help to stand the shock of failure. From the outset, battalions will have the greatest incentive to help each other, composed as they will be of men recruited from the same area, who know each other at home, and who may be, in many cases, related. This applies particularly to the Indian soldier with his very parochial mentality.

I feel that we will find that the regimental organization is, from the administrative point of view, particularly suited to the Indian Army. Many familiar problems would disappear were the regiment to be composed of battalions of the same race and religion whose men eat the same rations, who all do or do not smoke or drink—problems which have been part of the life of the regimental quartermaster throughout his tenure of office. This is no place to discuss the controversial question of one-class regiments versus mixed regiments, but I feel that most Indian Army officers will admit that questions of administration, including promotion, are far less complex in the one-class regiment than in the mixed. From the military standpoint, at any rate, bearing in mind the Indian soldier's outlook, I suggest that the enlargement of the one-class organization to regimental level would greatly simplify our administrative problems.

The adoption of the regimental organization would necessitate modification of the staff system. Staff officers would fall into two categories, "general" and "regimental." The regiment would be entirely staffed by the latter, and the present "G" staff officers in a brigade would be re-

placed by, say, a regimental adjutant and a regimental quartermaster. A separate staff course would be held for the training of these officers, and would be attended by candidates selected by the colonel of the regiment, under whom they would eventually serve. The advantage of having a fighting organization staffed by members of the units of which it is composed, and who have an intimate personal connection with it, are obvious. The same advantages would attend the replacement of a brigadier commanding three strange battalions, by a colonel commanding his own regiment.

This system should also produce a higher standard of general staff officer. Attendance at the regimental staff course, and the completion of a regimental staff appointment, would be compulsory qualifications for condidates for the general staff course. In the "half way house" which the regimental staff would represent, officers would become neither intensely regimental nor intensely staff minded. Knowing the difficulties both of the staff and the soldier, they would then be ideal material for general staff officers.

In the Indian Army, the nearest approach to an experiment in the direction of the regimental system was the establishment of Gurkha brigades, although these were not composed of battalions of the same regiment. These brigades won a high name for themselves in action, and the smooth running of their administration was the envy of staff officers of mixed brigades.

To sum up, there seems no doubt that the advantages of the adoption of the regimental system outweigh any possible drawbacks. It would give greater cohesion and efficiency in battle, easier administration in peace and war. Against this, the danger of concentration of casualties and some loss of flexibility do not weigh heavily. It is difficult to see what stands in the way of the adoption of the regimental organization, other than the traditional conservatism of the British and Indian races and armies.

Army-Air Organization for India's Defense

Digested by the MILITARY REVIEW from an article by Major General C. H. Boucher in "The Journal of the United Service Institution of India" October 1946.

THE tactical doctrine of the war of 1939-45 is well enough known; what we have to do is to be ready for the next war, and it is already apparent that the next war, if there is one, will be nothing like the last. The pigmy Indian Army that is emerging from the giant structure of the army of 1945 is an interim force, organized on last war lines and equipped with available—i.e., last war—weapons. It must be so in order that the immediate needs of India may be met, but already much of the equipment of the last war is obsolete.

Recently, too, in the realm of science there has occurred one of the greatest advances of the human era. For the first time, atomic energy has been harnessed to the purposes of war, and we are not yet able to say how far this discovery will lead us. Certain facts are already emerging, or have emerged sufficiently clearly to enable some deductions to be made as to our future defense requirements.

Armor

In the last war, generally speaking, tanks dominated the battlefield. Recent developments, however, have ended the dominion of the heavy tank, at any rate for the moment. He who has dominion in the air can concentrate rocket firing

fighter aircraft, in whose presence the heavy tank cannot exist. Even if bad weather or darkness prevents aircraft from operating, the recoilless gun and the improved antitank mine have robbed the tank of any superiority it may have enjoyed over the other arms.

We do not yet know what effect atomic energy may have in this matter of the efficacy of armor; it may go either way, but from what we do know it is probable that for the present the heavy tank is obsolete or at least obsolescent. Its uses are limited to those few places on the frontier where they can move, and to similar operations, where the enemy has no aircraft and no modern weapons.

In India it means that heavy armored brigades must be located in the vicinity of the place where they will fight, and this involves an accurate forecast of the battlefield and a risk of these expensive units never entering battle. It is the absolute negation of the principles on which the next war is likely to be fought—the principles of concentration and mobility. There is, therefore, a strong case for the exclusion of heavy armored formations from the Indian Army of the future, particularly as armor is probably the most expensive of the ingredients of our armed forces. Infantry, however, are still assault troops and are still soft-skinned. They still require armor in the assault to subdue the machine gun.

Owing to the distances involved, and the remote prospect of heavy enemy tanks ever covering the great mileages necessary to invade India it seems that the answer to India's armored problems lies on small, fast, light tanks which do not suffer from track troubles, which retain both strategical and tactical mobility, and and difficult targets for aircraft. The size will be limited by the limits of air transportation, and carriage of light tanks by air is already well within sight.

Supply

Supply is basic in war, and must be considered before possibilities of strategy or tactics which are dependent on it. It is the limiting factor to everything, and, therefore, the effects of the invention of the atomic bomb must be considered first. The results of an atomic bomb on a vital base such as Nagasaki have been seen. No nation will go to war unless they have an adequate supply of such missiles and the most modern means of launching them.

Our organization for the next war, therefore, must be based on numbers of small, dispersed bases in Central and Southern India, supplied mainly by transport aircraft. If this is admitted, the necessity of secrecy, of an adequate cover plan in peace, and of proper deception as to the location of these bases and their communications is of urgent importance.

The big ports of the present day are likely to be eliminated at the outset of war. This must be accepted and our supply lines from overseas organized accordingly. Dispersion will be necessary. Numbers of small ports with poor facilities will have to be used. The rail and road communications to all such ports must be established in peace, and war establishments worked out for organization of combined operations, for unloading into lighters, and by similar make-shifts.

As transport aircraft will carry an increasingly large share of the supply load, it will be necessary to establish a large number of airdromes all over India, so that they can be switched at will to alternative safe areas. We are already comparatively well off in this respect.

The Conditions of the Problem

The above are the basic facts of modern war on which our future organization must be based, and towards which our present organization, doctrine and thought must be directed. The principles to which

we must stick are mobility and speed, which involve flexibility and concentration.

There are certain other conditions or assumptions:

1. It must be assumed that India will have no possible intention of indulging in offensive action beyond her frontiers Her object is simply to repel aggression from across her borders and to maintain order within them.

2. As far as can be foreseen at present, any threat must be made from the northeast or northwest, and no nation is likely to be in a position to exert a threat of seaborne invasion.

3. There are very definite limitations to the money available for defense purposes.

4. First-class natural obstacles exist along the whole of the northern frontiers.

5. Within these natural frontiers lies a flat country of great distances, with good flying conditions, ideal for the movement of aircraft, but far too vast for the rapid movement of ground forces.

The Threat

Owing to the natural obstacles of India's northern frontiers, it is safe to assume that the first phase of any invasion of India must be airborne. Such a phase would immediately follow the destruction of all major bases by atomic bombs, and would be aimed at consolidating the moral effect of such action, paralyzing and replacing the government of India. Objectives for airborne landings are likely to be areas where the invaders can live on the country, and where there are plenty of good airfields or potential airfields and which are not atom-bomb targets. As in all airborne operations, there would be a follow-up force of ground troops, but the greater part of the build-up would have to be by air, owing to the distances and difficulties involved on the ground.

The attack would not be launched until the inevitable Fifth Column had done its work thoroughly, and it would follow a long period of subversive propaganda of the type with which the world has become familiar since Hitler's rise to power. There would, therefore, be risings within the country in favor of the invaders or liberators.

Organization for Defense

The principles to be followed, and the conditions of the problem have been stated. It remains to offer a solution.

1. *The Fifth Column Threat.*—The first threat is the Fifth Column, with its insidious propaganda. The countering of this most dangerous of all attacks is of vital importance, because unless the way has been prepared by the enemy by some such means, no other invasion is likely to follow. It is a responsibility mainly of the civil government, although the armed forces are of course vitally interested, and as far as army-air organization is concerned, a considerable intelligence commitment is involved.

2. *The Airborne Threat.*—Air superiority is the first requirement for an airborne operation, or for that matter, for any major operation. The air force, therefore, will be the predominant arm in the defense of India, and it is sound to argue that the Supreme Commander should be chosen from that service. This headquarters must certainly be fully integrated, and the defense plan mutually adjusted and combined between all services from the start.

Our first object in organizing for defense must be to win the local air battles. We can afford only a very small air force, and we have no aggressive intentions. We cannot, therefore, hope to fight beyond the frontiers. All we can hope to do is to hold off any threat until assistance can be sent from overseas. So long as the threat can be confined to airborne invasion this should be within our powers.

The great strength of air power lies in its speed and flexibility. These are

the principles which will guide Empire defense and which will bring aid to India, and these are the principles which must guide India's plan for her own defense.

The decisive points will be those where enemy airborne forces have landed. The role of the air force will be to get the airborne troops to these decisive points. The army's role will be to stamp out such landings before they can take root. All airborne battle groups within reach will be concentrated in turn on enemy landings, under air cover and in aircraft provided by the air force. The locations of these airborne battle groups will be decided by their distance from probable enemy objectives, and can be worked out on a map by compass, according to the endurance of the transport aircraft of the time.

There will be no place in the army for any combat troops who are not airborne or airtransported. Parachuting will be part of everyone's basic training, and any recruits who, for any reason, are unable to jump, will be relegated to the ground services. In fact, however, parachuting is already obsolescent, and the airborne assault troops of perhaps only a few years hence will land from helicopters, or from some other airborne vehicle which will enable a whole platoon or more to be put down with all its weapons and equipment. The cumbersome, top-heavy divisions of the last war are dead. Future organization must be by battle groups, probably about the size of a para brigade group now organized, but in fact limited by the possibilities of air lift and air cover. A complete change in outlook and in doctrine is required in the army, and here I quote Lord Tedder:

"Although the Germans had excellent integration between their air and land forces, they thought in terms of land the whole time. They were not prepared to fight an air battle; they were neither equipped nor trained for it.

"Each service must clear out old shiboleths and outworn traditions, go to the scientists and technicians for all they can possibly give in the way of speed, mobility and economy, develop the whole time with an eye on the other two members of the team in cooperation and not in competition."

The army is as yet far from being sufficiently air minded. It is still thinking in terms of land and of the last war.

3. *The Land-Borne Threat.*—Finally, there is the problem of an invasion by land. No major land operation can succeed without air superiority, nor could any land forces of the last war hope to make much progress against the flexibility and speed of the airborne type of forces envisaged above. We have to insure, however, that India's frontiers, which are naturally very formidable are in fact sufficient obstacles to force any aggressor into an airborne invasion, the defeat of which would be within our possibilities, and to prevent his ground or follow-up component from reaching him.

For this purpose, we need land forces who can make the greatest possible use of the difficult frontier country along any of the possible lines of invasion. The tribesmen who inhabit the frontier region are the best possible troops for the job.

On the north, there is no threat through the Himalayas. On the northeast frontier something similar to the Scouts of the northwest frontier may exist or could be organized. Irregular frontier corps require the backing of regular troops, and these should be for the most part ground troops of the defensive or fortress type, machine gunners, and sappers for laying mines and making demolitions. The object is to turn the northeast and northwest frontiers into fortress areas which, by reasons of their natural difficulties and their warlike inhabitants, can be held economically and securely by fortress troops.